ENVIRONMENTAL PARTNERS INC

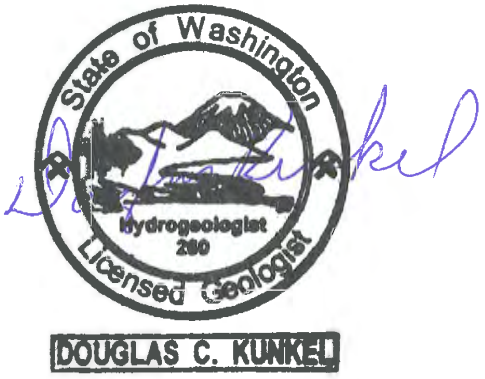
2-66 Enhanced Reductive Dechlorination Interim Measure – Final Report

Boeing Plant 2
Seattle/Tukwila, Washington

Prepared For:

The Boeing Company
P.O. Box 3707
M/C 1W-12
Seattle/Tukwila, WA 98124

July 20, 2011



Prepared By:

Environmental Partners, Inc.
295 N.E. Gilman Blvd., Suite 201
Issaquah, Washington 98027
(425) 395-0010

Jeff Dengler, PhD, PE
Senior Engineer

Douglas Kunkel, LG, LHG
Principal Hydrogeologist

Project Number: 17513.0.2

QR DK TR DK

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 INTERIM MEASURE IMPLEMENTATION 3

3.0 PERFORMANCE MONITORING METHODOLOGY 4

4.0 PERFORMANCE MONITORING RESULTS 6

4.1 Ninth Quarter Sampling Results 6

4.2 Tenth Quarter Sampling Results 7

4.3 Data Trend Analysis 8

5.0 OVERALL IM PERFORMANCE EVALUATION 10

6.0 CONCLUSIONS 11

7.0 SCHEDULE 12

8.0 REFERENCES 13

TABLES

Table 1 – 2-66 ERD IM Groundwater Field Parameter Summary
Table 2 – 2-66 ERD IM Ninth Quarter Groundwater Monitoring Analytical Results (January 2011)
Table 3 – 2-66 ERD IM Tenth Quarter Groundwater Monitoring Analytical Results (April 2011)
Table 4 – 2-66 ERD IM Groundwater Monitoring Analytical Data Summary
Table 5 – 2-66 ERD IM Overall Performance Summary

FIGURES

Figure 1 – General Location – Boeing Plant 2
Figure 2 – Site Representation
Figure 3 – Plan View of the 2-66 ERD IM
Figure 4 – VOC Trend Plots for PL2-021A and PL2-035A
Figure 5 – VOC Trend plots of PL2-010A and PP-4B-I

ATTACHMENTS

Attachment A – Field Parameter Data
Attachment B – Groundwater VOC Analytical Data – All Detections
Attachment C – Field Notes
Attachment D – Data Validation Reports

ACRONYMS

bgs	below ground surface
cells/ml	halorespirer bacterial cells per milliliter
CMS	Corrective Measures Study
COC	contaminant of concern
^{o}C	degrees Celsius
DCE	dichloroethene
DDC	density-driven convection
DO	dissolved oxygen
DPT	direct-push technology
EPA	United States Environmental Protection Agency
EPI	Environmental Partners, Inc.
ERD	enhanced reductive dechlorination
IM	Interim Measure
mg/L	milligrams per liter
mS/cm	milliSiemens per centimeter
mV	millivolts
µg/L	micrograms per liter
NTU	nephlometric turbidity units
NO_3	nitrate ion
ORP	oxidation-reduction potential
RT-PCR	real time polymerase chain reaction
SAP	Sampling and Analysis Plan
SO_4	sulfate ion
TCE	trichloroethene
TMCL	Target Media Cleanup Level
TOC	total organic carbon
VC	vinyl chloride
VOC	volatile organic compound

1.0 INTRODUCTION

This fifth and final semiannual report presents data and evaluations of the ninth and tenth quarterly sampling results for the Enhanced Reductive Dechlorination (ERD) Interim Measure (IM) at the 2-66 Sheetpile in the 2-66 Area at Boeing Plant 2. This report presents data generated during the time period from November 2010 through April 2011 and includes evaluations of data generated throughout the performance of this IM.

Ongoing demolition and construction work at Plant 2 has resulted in limited access to monitoring wells associated with the 2-66 ERD IM. In addition, heavy truck traffic through the area containing the 2-66 ERD IM monitoring well network has made groundwater sampling unreasonably dangerous and disruptive to surrounding operations. Boeing requested approval from the United States Environmental Protection Agency Region X (EPA) to discontinue groundwater monitoring and reporting associated with the 2-66 ERD IM and transition this IM into the Corrective Measures Study Report (CMS) process. EPA approved Boeing's request to terminate ongoing groundwater monitoring and reporting associated with the 2-66 ERD IM in an email dated June 2, 2011.

Accordingly, the IM will end with the April 2011 monitoring event, and this final semiannual report will include an overall ERD performance evaluation for the 2-66 ERD IM. IMs historically performed at this specific location are installation of a hanging sheetpile in 1998, implementation of density-driven convection (DDC) in 2004, and ERD implementation in 2008.

In a letter dated August 18, 2008 from the EPA to Boeing, EPA gave approval to implement the *Interim Measure Work Plan for 2-66 Sheetpile* (Environmental Partners, Inc. [EPI], 2008). This work plan presented details for continued remediation to be performed on groundwater impacted by chlorinated volatile organic compounds (VOCs) inside the 2-66 Sheetpile. Figure 1 presents a general location map of Plant 2 and Figure 2 is a site representation showing the location of the 2-66 Sheetpile within Plant 2.

In a letter to Boeing dated September 17, 2009, EPA required two modifications to the approved 2-66 ERD IM work plan. The modifications are:

- Quarterly sampling of all monitoring wells inside of the 2-66 sheetpile for chlorinated VOCs, metals, and pH; and
- Quarterly sampling of wells PL2-041AA (PL2-008A), PP-2B-O, and PP-4B-O for chlorinated VOCs, metals, and pH.

The EPA letter also specified that Boeing should continue to follow the approved work plan to sequence analyses for other constituents at selected wells inside the sheetpile. In response to this letter, Boeing issued a revised *Interim Measure Work Plan for 2-66 Sheetpile* dated October 19, 2009 (EPI, 2009a). The work plan modifications added wells PL2-041AA (PL2-008A), PL2-008C, PP-2B-O, and PP-4B-O to the monitoring schedule beginning with the fourth quarter 2009 sampling event (October 2009).

Two IMs were previously completed in this area. In 1994, the 2-66 sheetpile structure was installed to contain the bulk of high-concentration VOCs in soil and to prevent migration of VOC-impacted groundwater to the Duwamish Waterway. A 2001 study concluded that, based on hydraulic and contaminant concentration data, the 2-66 Sheetpile structure effectively contains the bulk of VOC impacted soil and groundwater in the area (Weston, 2001). In 2004, two DDC wells were installed inside the sheetpile to remediate vadose zone soil and groundwater within the 2-66 Sheetpile structure. Results of an evaluation performed in 2006 indicated that the chlorinated VOC mass inside the sheetpile was reduced by approximately 98 percent in both soil and groundwater as reported in the *Interim Measure Evaluation and Completion Report at the Building 2-66 Sheetpile* (EPI, 2007a). This report concluded that continued operation of the DDC system to remediate the last few hundred pounds of VOCs would be inefficient and remediation could be more effectively and efficiently performed using *in situ* ERD. Based on this conclusion Boeing proposed, and EPA approved, the application of ERD as the next IM remediation step at the 2-66 Sheetpile.

Analytical results presented in the *2-66 Area Data Gap Investigation Report* (EPI, 2007b) indicate that the main contaminants of concern (COCs) inside the 2-66 Sheetpile are the chlorinated VOCs trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC). Figures showing the distribution and constituent concentrations of impacted groundwater within the sheetpile structure are presented in the *2-66 Area Data Gap Investigation Report* (EPI, 2007b) and in the IM Work Plan (EPI, 2009a). Figure 3 presents the 2-66 Sheetpile and vicinity showing direct-push technology (DPT) injection point locations and monitoring wells associated with the ERD IM.

2.0 INTERIM MEASURE IMPLEMENTATION

ERD is an *in situ* chemical application that temporarily modifies groundwater geochemistry to promote the growth of halorespirer bacteria that are effective in the sequential reductive dechlorination of chlorinated VOCs. Under appropriate geochemical conditions certain anaerobic bacteria can metabolize chlorinated VOCs by successively removing chlorine atoms from the ethene backbone until only ethene or ethane gas remains.

Implementation of the 2-66 ERD IM consisted of the following steps, which were reported in *2-66 Enhanced Reductive Dechlorination Interim Measure – First Semiannual Report* (EPI, 2009b).

- Baseline groundwater monitoring
- Injection of the nutrient substrate solution
- Performance monitoring of the remedial technology

Baseline groundwater sampling was performed at 15 monitoring wells inside the 2-66 Sheetpile on August 27 and September 2 and 3, 2008. Baseline monitoring was conducted to provide initial COC concentrations and subsurface geochemical conditions prior to implementing ERD.

A nutrient substrate solution of approximately 6 percent sugar and 2,400 milligrams per liter (mg/L) of sodium bicarbonate buffer in potable water was injected by DPT into a grid of 26 locations spread uniformly inside of the 2-66 Sheetpile at the locations shown in Figure 3. The initial nutrient substrate injections took place from October 7 to 16, 2008. Because the B level of the aquifer is naturally more anaerobic at Plant 2, a lesser volume of nutrient substrate was injected to promote ERD in the B level. Approximately 9,500 pounds of sugar was injected throughout the 2-66 Sheetpile; 7,520 pounds (13,400 gallons of substrate) were injected into the A level and 1,980 pounds (3,500 gallons of substrate) were injected into the B level. A more detailed description of the nutrient substrate injection is presented in the First Semiannual Report (EPI, 2009b).

Groundwater pH was routinely monitored after injections. Additional buffer solution of sodium bicarbonate dissolved in potable water was added twice to some of the 2-66 Sheetpile wells to increase and buffer groundwater pH to levels appropriate for bacterial growth. Low pH measurements have not been noted in most wells associated with the 2-66 ERD IM after the initial baseline conditions.

A second nutrient substrate injection was conducted from May 4 through May 13, 2010. The second injection was similar to the first injection and was based on the need to replenish nutrient substrate concentrations to maintain geochemical conditions favorable for ERD.

3.0 PERFORMANCE MONITORING METHODOLOGY

Performance groundwater monitoring is done on a quarterly basis to evaluate the degree of success and effect of the ERD remedial treatment. Performance monitoring results are compared to baseline monitoring results and previous performance monitoring results to evaluate changes in contaminant concentrations and trends in subsurface conditions. The first eight quarters of performance monitoring and the associated 2-66 ERD IM reports are listed below.

First Quarter	January 20, 21, 2009	
Second Quarter	April 20, 21, 2009	First Semiannual Report (EPI, 2009b)
Third Quarter	July 20, 21, 2009	
Fourth Quarter	October 19, 20, 2009	Second Semiannual Report (EPI, 2010a)
Fifth Quarter	January 18 - 20, 2010	
Sixth Quarter	April 19 - 22, 2010	Third Semiannual Report (EPI, 2010b)
Seventh Quarter	July 20 - 22, 2010	
Eighth Quarter	October 18 - 21, 2010	Fourth Semiannual Report (EPI, 2011)

Groundwater samples were collected using the methods and procedures presented in Section 3.3 "Sampling Procedures" of the Sampling and Analysis Plan (SAP), presented in Appendix A of the revised IM Work Plan (EPI, 2009a). Monitoring wells sampled for this IM are listed below and their locations are shown in Figure 3.

- PL2-010A
- PL2-017A
- PL2-021A
- PL2-021B
- PL2-021C
- PL2-031A
- PL2-032A
- PL2-035A
- PL2-041AA* (-008A)
- PL2-008B
- PL2-008C*
- PP-1B-I
- PP-2B-I
- PP-2B-O*
- PP-3A-I
- PP-3B-I
- PP-4B-I
- PP-4B-O*
- PP-5B-I

The four wells marked with an asterisk were added to the performance monitoring network as directed by EPA in its September 17, 2009 letter to Boeing. These additional four wells were sampled starting with the fourth quarter sampling event, October 2009.

Groundwater samples from all 19 wells are analyzed for VOCs by EPA Method 8260C and arsenic and manganese by EPA Methods 200.8 and 6010B. Selected groundwater samples are also analyzed for the following additional constituents:

- Total organic carbon (TOC) by EPA Method 415.1;
- Dissolved gases (methane, ethane, and ethene) by EPA Method RSK-175 (modified);
- Ferrous iron by Method 3500-FED;
- Anions (nitrate [NO_3] and sulfate [SO_4]) by EPA Method 300;
- Organic (fatty) acids by ion chromatography; and
- Bacterial census of halorespirers by the Bio-Dechlor Census Test RT-PCR.

Tables in the SAP of the revised IM Work Plan included in Appendix A (EPI, 2009a) present the sampling and analysis schedule and specifications for analytical method reporting limits, containers, preservation, and holding times.

Some groundwater samples from 2-66 ERD IM wells effervesced when exposed to hydrochloric acid in preserved VOC sample vials. This reaction can adversely affect VOC analytical results by stripping VOCs from the sample. To reduce the impact of effervescing samples on analyses, these samples were collected using unpreserved (i.e., no hydrochloric acid) sample vials. This necessary variation from the VOC sampling process, which is documented in the 2-66 ERD IM Work Plan, is consistent with approved VOC sampling procedures in Plant 2 data gap investigation work plans. The use of unpreserved sample vials does not adversely affect sample quality or the analytical reporting limits; however, the unpreserved sample holding time is reduced from 14 days to 7 days.

4.0 PERFORMANCE MONITORING RESULTS

4.1 Ninth Quarter Sampling Results

The ninth quarter of performance monitoring was performed on January 17 to 19, 2011. Field parameter measurements made during sampling are presented in Table 1 and Attachment A. Ninth quarter groundwater analytical data are presented in Table 2 and Attachment B. Field notes for the ninth quarter monitoring event are presented in Attachment C. Data validation results are presented in Attachment D.

Concentrations of the main chlorinated VOC constituents (TCE, DCE, and VC) at well PL2-035A have continued to decrease from greater than 1,000 micrograms per liter (µg/L) and are now all at concentrations less than 1,000 µg/L. Chlorinated VOC concentrations in samples from PL2-010A, PL2-021A, and PL2-041AA are also at concentrations less than 1,000 µg/L. All other samples have chlorinated VOC concentrations that range from less than 4 µg/L to not detected.

Ethane and ethene are the final daughter products of reductive dechlorination of TCE, DCE, and VC. Detected concentrations of ethane and ethene dissolved gas in samples from PL2-021A, PL2-032A, and PL2-035A indicate that the ERD process has fully dechlorinated (destroyed) some of the chlorinated VOC mass in groundwater in the vicinities of these wells. Field parameter measurements, methane, and ferrous iron concentrations in samples from these same wells also provide data that indicate the IM has achieved the geochemically reducing conditions necessary for ERD, and that the IM design has been achieving this fundamental objective.

TOC concentrations, which are used to evaluate the presence of nutrient substrate, range from 2.33 milligrams per liter (mg/L) at PP-5B-I to 1,260 mg/L at PP-1B-I. TOC concentrations in samples from most wells have decreased from eighth quarter values, with a few TOC concentrations remaining almost unchanged. An exception is well PP-1B-I, at which the sample TOC concentration increased from 168 mg/L during the eighth quarter to 1,260 mg/L during the ninth quarter. This increase is likely a localized effect and is not representative of the general TOC trend. Static groundwater conditions inside the sheetpile limit mixing and dilution of the nutrient substrate by groundwater flow. Due to the sheetpile structure there is no advective flow of groundwater to mix and distribute TOC throughout the aquifer area enclosed by the sheetpile. Tidal pressure fluctuations and diffusion are the main mechanisms available to distribute the nutrient substrate inside of the sheetpile. Injection locations were distributed in a grid pattern across the area inside of the sheetpile. The proximity of injection points to monitoring wells might cause TOC concentration differences in individual wells and differences from quarter to quarter.

The solubility of some metals, notably arsenic and manganese, increases under reducing geochemical conditions and also under low pH conditions. Both of these geochemical conditions can be caused by the ERD process; therefore, arsenic and manganese analyses are included as part of the performance monitoring program. Evaluation of field measured pH data from the 2-66 ERD IM sampling indicates that groundwater is generally in the neutral range of 6.0 to 8.5 and in

most cases has become more neutral, relative to baseline conditions since nutrient substrate injection, which contained a buffer to maintain pH conditions favorable for growth of bacterial populations.

The greatest arsenic concentration noted during the ninth quarter was 17.2 µg/L in the sample from PL2-021A. This concentration is greater than the Plant 2 Target Media Cleanup Level (TMCL) concentration of 8 µg/L. The arsenic concentration in the baseline sample from PL2-021A was 0.9 µg/L, but increased to concentrations greater than the Plant 2 TMCL during the first sampling event after the initial nutrient substrate injection. The baseline sample from PL2-021A had the greatest initial TCE concentration of all the wells in the 2-66 ERD IM monitoring network. Arsenic concentrations in samples from all other wells were less than the Plant 2 TMCL.

Manganese concentrations in samples from all 2-66 ERD IM monitoring wells were less than the Plant 2 TMCL of 2,000 µg/L for manganese.

The presence and population of halorespirer bacteria are a significant indication of the effectiveness of the ERD process. The addition of nutrient substrate is specifically intended to increase populations of these bacterial species. Bacterial census for halorespirer concentrations at PL2-017A and PL2-021A (the only wells analyzed for this parameter) indicate relatively unchanged populations from the eighth quarter of halorespirer microorganisms required for ERD.

4.2 Tenth Quarter Sampling Results

The tenth quarter performance monitoring was performed April 18 to 21, 2011. Field parameter measurements made during sampling are presented in Table 1 and Attachment A. Tenth quarter groundwater analytical data are presented in Table 3 and Attachment B. Field notes for the tenth quarter monitoring event are presented in Attachment C. Data validation results are presented in Attachment D.

Chlorinated VOC results for tenth quarter samples are only slightly changed from ninth quarter results. TCE and VC concentrations in the sample from PL2-035A increased slightly but remain less than 1,000 µg/L for both constituents. Chlorinated VOC concentrations in samples from most other wells were relatively unchanged or increased slightly.

Ethane and ethene gas, the end products of reductive dechlorination, were again detected in samples from wells PL2-021A, PL2-032A, and PL2-035A. Detected concentrations of ethane and ethene indicate that the ERD process has fully dechlorinated some of the chlorinated VOC mass in groundwater in the vicinities of these wells. Field parameter measurements, methane, and ferrous iron concentrations in samples from these same wells also provide data that indicate the IM has achieved the geochemically reducing conditions necessary for ERD.

TOC, dissolved gases, ferrous iron, anion, and organic acid concentration results for tenth quarter samples were similar or slightly decreased relative to ninth quarter results. The data trend evaluation discussion in the following section will provide additional evaluation of the recent data. The TOC concentration in the sample at PP-1B-I significantly decreased in the tenth quarter, indicating that the localized concentration spike noted in the ninth quarter results is resolving itself.

The greatest concentration of arsenic noted during the tenth quarter was 13.5 µg/L in the sample from PL2-021A. The arsenic concentration has decreased relative to the ninth quarter event but is still greater than the Plant 2 TMCL concentration of 8 µg/L. Arsenic concentrations in samples from all other wells were less than the Plant 2 TMCL.

Manganese concentrations in samples from all 2-66 ERD IM monitoring wells were less than the Plant 2 TMCL concentration of 2,000 µg/L for manganese.

Bacterial census population values increased slightly relative to ninth quarter results in the sample from PL2-017A and were generally unchanged in the sample PL2-021A. The continued presence and population of halorespirer bacteria at significantly greater populations than baseline conditions in these two wells are an indication of the effectiveness of the nutrient substrate injections and the ERD process.

4.3 Data Trend Analysis

Table 4 presents analytical results for baseline and ten quarters of performance monitoring. Observations regarding ERD progress at the 2-66 Sheetpile, based on analytical results over the time period since the initial nutrient substrate injection, are presented in the following paragraphs.

Chlorinated VOC data for PL2-021A and PL2-035A presented in Table 4 and shown graphically in Figure 4 indicate that TCE concentrations decreased over time with corresponding temporary increases in the concentrations of less-chlorinated VOCs (i.e., DCE and VC). Continued implementation of the ERD IM resulted in decreasing concentrations of all chlorinated VOCs, including the less-chlorinated VOCs.

TCE concentrations in samples from PL2-021A were relatively large for the baseline sampling event and decreased during successive quarterly sampling events. DCE concentrations initially increased, likely due to reductive dechlorination from TCE to DCE, and then decreased over subsequent sampling events. After a delay, VC concentrations temporarily increased as VC was likely produced from reductive dechlorination of DCE. Data from the fourth through the ninth quarters indicate that VC concentrations steadily decreased with a slight increase during the tenth quarter. Increases in ethane and ethene dissolved gas concentrations, the final products of ERD, correspond with the decreased chlorinated VOC concentrations.

A similar progression from more chlorinated VOCs to less-chlorinated VOCs is demonstrated by the data for samples from PL2-035A as presented in Figure 4. At this location the shift in chlorinated VOC concentrations is limited to DCE and VC data possibly caused by TCE at very low concentrations during baseline sampling and for all sampling events.

The chlorinated VOC data for samples from PL2-010A and PP-4B-I are presented graphically in Figure 5. The time series graph for PL2-010A shows a decrease of TCE concentrations with a shift to increased concentrations of DCE and VC through the sixth quarter. From the seventh through tenth quarters DCE and VC concentrations have continued to decrease, but there was an increase in TCE concentrations.

High baseline concentrations of DCE and VC in samples from PP-4B-I decreased rapidly following the initial substrate injection, and then temporarily increased slightly during the third quarter as shown in Figure 5. Current DCE and VC concentrations in samples from PP-4B-I are non-detect or detected at concentrations near the detection limit of 0.2 µg/L, as presented in Table 4.

Although data variability makes interpretation of data tends from wells with initially low chlorinated VOC concentrations difficult, data supporting demonstrations of the ERD process are evident in the sample results from wells PL2-008B, PL2-032A, PP-2B-I, PP-2B-O, and PP-4B-O. The chlorinated VOC data for samples from these wells support demonstrations of the ERD process and are presented in Table 4.

The presence of dissolved gases, ferrous iron, and organic acid concentrations as well as halorespirer bacteria populations in samples from some wells indicates favorable responses to nutrient injections resulting in successful and ongoing ERD.

As indicated in Table 1, the lowest measured pH values in groundwater from 2-66 ERD IM monitoring wells were generally noted during baseline sampling. Over time pH values have moderated and the second nutrient substrate injection at the 2-66 sheetpile has not resulted in any new low pH measurements, which can occur with ERD.

5.0 OVERALL IM PERFORMANCE EVALUATION

Table 5 presents individual and total chlorinated VOC data for each 2-66 ERD IM monitoring well for baseline and recent quarterly sampling events and presents the calculated percent reduction in total VOCs for each well. Two wells, PL2-031A and PP-3B-I, had low baseline chlorinated VOC concentrations followed by consistent decreases then anomalous increases during the tenth quarter sampling event. For these two wells, the percent reduction was based on the average eighth and ninth quarterly event data, which was more representative of the larger data set for the wells. Four wells, PL2-0041AA, PL2-008C, PP-2B-O, and PP-4B-O, were added to the monitoring program after the IM began (refer to September 17, 2009 letter from EPA to Boeing) and 4th quarter data was used as the baseline for these wells.

Generally, wells with total chlorinated VOC baseline concentrations greater than approximately 30 µg/L tended to give more consistent and reliable overall performance results than wells with total chlorinated VOC baseline concentrations less 30 µg/L. The reason is that low total VOC concentration wells had greater sensitivity to data variability, which resulted in greater variability in the percent reduction calculation.

With the exception of well PL2-010A, wells with initial total chlorinated VOC concentrations greater than 30 µg/L (i.e., PL2-041AA, PL2-008B, PL2-021A, PL2-032A, PL2-035A, PP-2B-I, PP-2B-O, PP-4B-I, and PP-4B-O) have data with overall reductions in total chlorinated VOCs ranging from 61 percent for PL2-041AA to 99 percent for PL2-032A, PP-2B-I, PP-4B-I, and PP-4B-O. The average percent reduction for total chlorinated VOC concentrations for these wells is approximately 90 percent. It is technically valid to give more credence to data from wells with greater initial concentrations of chlorinated VOCs because normal data variability has less impact on the calculation of overall ERD performance.

Chlorinated VOC data from PL2-010A had high initial concentrations but experienced an increase in contaminant concentrations relative to baseline data during operation of the IM. Quarterly data present in Table 4 and Figure 5 indicate that ERD was proceeding as intended at this well during the 4th, 5th, and 6th quarters. Individual chlorinated VOC data for this period show the concentration change and shift from TCE to lesser-chlorinated VOCs typical of ERD performance. However, TCE concentrations increased during the 7th, 8th, 9th, and 10th quarters following the second nutrient substrate injection event, which was performed between the 6th and 7th quarterly sampling events. PL2-010A is located within a chlorinated VOC source area in the vadose zone within the 2-66 sheetpile. It is possible that the second nutrient substrate injection flushed chlorinated VOCs from vadose zone soil into the groundwater during temporary groundwater mounding caused by nutrient substrate injections.

Wells with low initial total chlorinated VOC concentrations (i.e., PL2-008C, PL2-017A, PL2-021B, PL2-021C, PL2-031A, PP-1B-I, and PP-3B-I) have overall changes in total chlorinated VOC concentrations ranging from a decrease of 100 percent to an increase of 43 percent. Small concentration variations due to natural variability and other factors not related to ERD in these low concentration wells could create large changes in the contaminant concentration percent reduction calculation.

6.0 CONCLUSIONS

The first nutrient substrate injection performed in October 2008 initiated the ERD process, which, in turn, stimulated microorganisms in the subsurface to reductively dechlorinate and destroy chlorinated VOCs in groundwater. The second nutrient substrate injection performed in May 2010 provided the necessary nutrient load to groundwater to continue the ongoing ERD process. As a result, chlorinated VOC concentrations for samples from 15 of the 19 monitoring wells sampled for the 2-66 ERD IM have decreased and/or shifted to less-chlorinated forms.

Ethene gas, the end product of reductive dechlorination, was detected in samples at three of the five 2-66 ERD IM wells that were sampled for dissolved gases. The presence of ethene gas in groundwater samples demonstrates that reductive dechlorination of the chlorinated VOCs is occurring. The two wells where ethene was not detected in groundwater samples had very low (single digit) concentrations of chlorinated VOCs throughout their IM sampling history and are, therefore, not expected to generate detectable concentrations of highly volatile ethene gas.

The overall performance evaluation for the approximate 2.5 years of ERD remedial operation indicate an approximate 90 percent overall reduction of total chlorinated VOC mass within the 2-66 sheetpile. Performance results for individual wells are variable depending on initial VOC concentration. Tidal pressure fluctuations and the slow, dispersion-dependent nature of VOC and nutrient substrate distribution within the sheetpile also likely contributed to data variability.

Operation of the 2-66 ERD IM was successful at establishing and maintaining reducing geochemical conditions favorable for reductive dechlorination of chlorinated VOCs. In addition, bacterial census data indicate that nutrient substrate injections increased halorespirer bacteria populations significantly as demonstrated by samples from well PL2-021A.

The success of this IM is demonstrated and quantified by the approximately 90 percent reduction in chlorinated VOC concentrations in 2-66 ERD IM samples from wells with initial total chlorinated VOC concentrations greater than 30 µg/L. Over the course of both the DDC and ERD IMs performed at the 2-66 Sheetpile, the mass of chlorinated VOCs in groundwater has now been reduced approximately 99 percent. Additionally, the DDC IM was calculated to have reduced the mass of chlorinated VOCs in soil by approximately 98 percent. The DDC IM system performance was reported in “Interim Measure Evaluation and Completion Report at the Building 2-66 Sheetpile” (EPI, 2007a).

7.0 SCHEDULE

This report is the final semiannual report associated with the 2-66 ERD IM. Groundwater monitoring and reporting associated with this IM has been discontinued. Groundwater remediation through ERD processes will continue as long as sufficiently reducing geochemical conditions induced by IM nutrient injections are present in the aquifer.

Additional remediation measures will be evaluated in the Corrective Measures Study currently being performed at Plant 2. Selected soil and groundwater remedies will be performed during Corrective Measures Implementation as necessary and approved through the CMS process.

8.0 REFERENCES

EPI, 2007a Environmental Partners, Inc. "Interim Measure Evaluation and Completion Report at the Building 2-66 Sheetpile." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. November 21, 2007.

EPI, 2007b Environmental Partners, Inc. "2-66 Area Data Gap Investigation Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. June 15, 2007.

EPI, 2008 Environmental Partners, Inc. "Interim Measure Work Plan for 2-66 Sheetpile." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. July 3, 2008. [OBSOLETE, see EPI, 2009a]

EPI, 2009a Environmental Partners, Inc. "Interim Measure Work Plan for 2-66 Sheetpile." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. October 19, 2009.

EPI, 2009b Environmental Partners, Inc. "2-66 Enhanced Reductive Dechlorination Interim Measure – First Semiannual Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. June 26, 2009.

EPI, 2010a Environmental Partners, Inc. "2-66 Enhanced Reductive Dechlorination Interim Measure – Second Semiannual Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. January 20, 2010/March 11, 2010 (revised).

EPI, 2010b Environmental Partners, Inc. "2-66 Enhanced Reductive Dechlorination Interim Measure – Third Semiannual Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. July 21, 2010/September 30, 2010 (revised).

EPI, 2011 Environmental Partners, Inc. "2-66 Enhanced Reductive Dechlorination Interim Measure – Fourth Semiannual Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. January 19, 2011.

Weston, 2001 Roy F. Weston, Inc. "Initial CMS Phase Effectiveness of Buildings 2-10 and 2-66 Interim Measures Monitoring Report." Boeing Plant 2. The Boeing Company, Seattle/Tukwila, Washington. August 29, 2001.

TABLES

Table 1. 2-66 ERD IM Groundwater Field Parameter Summary

Well	Event	Date	Time	Depth to Water (feet)	Total Volume Purged (gallons)	pH	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTUs)	Specific Conductivity (mS/cm)	Comments
PL2-041AA	4th Quarter	10/20/09	10:15	8.50	3.1	7.44	0.89	-3.0	16.04	4.33	1.290	clear, yellow
	5th Quarter	1/20/10	10:41	7.85	3.2	7.51	0.30	-161	13.95	4.33	1.055	clear
	6th Quarter	4/20/10	12:29	9.02	1.8	7.53	0.61	21.3	13.15	2.42	1.017	clear
	7th Quarter	7/21/10	13:48	10.93	1.4	7.27	0.58	-108	16.33	3.78	0.955	clear, colorless
	8th Quarter	10/20/10	15:03	10.91	2.5	7.81	0.84	-54.5	16.24	5.50	1.067	clear
	9th Quarter	1/18/11	12:55	8.82	3.5	8.17	0.56	-45.2	13.30	3.13	1.040	clear
	10th Quarter	4/18/11	13:45	9.88	2.3	7.71	0.57	-33.0	12.36	1.63	0.927	clear
PL2-008B	Baseline	9/2/08	14:03	10.55	3.3	5.91	0.07	-90.1	14.70	NM	3.416	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	14:09	11.21	1.5	7.55	0.14	-149	15.29	0.83	2.637	clear
	4th Quarter	10/20/09	12:26	9.88	2.3	6.85	0.85	-38.2	14.42	1.06	4.179	clear
	5th Quarter	1/20/10	9:36	8.09	4.2	6.68	0.20	-236	13.34	1.52	5.159	clear
	6th Quarter	4/21/10	8:40	9.41	2.5	7.02	0.45	-139	12.54	8.03	4.068	clear
	7th Quarter	7/21/10	14:56	11.50	2.2	5.36	0.24	-105	15.87	5.96	3.939	clear, colorless
	8th Quarter	10/18/10	11:45	11.45	2.6	6.33	0.47	1.6	14.60	3.58	4.079	clear
	9th Quarter	1/18/11	14:00	9.24	1.5	7.06	0.58	-89.9	11.38	5.97	4.156	clear
	10h Quarter	4/18/11	12:17	10.52	2.5	6.55	0.75	-41.3	13.70	6.51	3.741	clear
PL2-008C	4th Quarter	10/20/09	11:01	9.40	1.6	7.88	0.89	17.3	14.15	0.79	5.781	clear
	5th Quarter	1/20/10	10:04	7.09	2.2	7.92	0.22	-230	13.38	0.45	4.550	clear
	6th Quarter	4/20/10	14:11	NM	1.5	7.75	0.51	40.0	14.29	0.19	5.824	clear
	7th Quarter	7/21/10	14:22	11.90	1.4	7.71	0.43	-196	17.89	0.88	6.012	clear, colorless
	8th Quarter	10/21/10	7:19	11.48	2.9	7.97	0.85	31.8	13.69	3.03	6.032	clear
	9th Quarter	1/18/11	13:33	8.80	1.5	8.32	0.40	-118	12.74	0.91	6.000	clear
	10th Quarter	4/18/11	12:50	11.67	2.0	7.41	0.45	-106	13.64	0.87	5.960	clear, yellow
PL2-010A	Baseline	9/2/08	11:35	10.22	2.7	4.00	0.20	126	14.99	6.15	3.768	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	11:34	10.42	1.5	5.87	0.18	88.1	15.73	0.36	2.297	clear
	4th Quarter	10/21/09	11:10	9.59	2.3	5.68	0.68	89.3	15.20	1.14	2.709	clear
	5th Quarter	1/19/10	10:20	8.26	2.9	5.16	0.42	137	15.16	2.55	2.585	clear
	6th Quarter	4/22/10	8:45	9.14	1.5	5.29	0.51	86.0	13.93	1.49	3.859	clear
	7th Quarter	7/21/10	11:18	10.92	1.1	4.87	0.31	-39.6	16.23	2.64	1.975	clear, colorless
	8th Quarter	10/18/10	14:00	10.98	3.0	7.05	0.34	-15.4	16.09	4.98	1.873	clear
	9th Quarter	1/19/11	9:37	8.90	2.0	6.20	0.78	-25.3	14.19	8.74	1.267	clear
	10th Quarter	4/21/11	8:27	9.98	2.2	6.07	2.43	110	12.56	8.18	0.976	clear
PL2-017A	Baseline	8/27/08	11:20	10.28	5.2	6.26	0.77	-118	16.90	45.8	15.71	clear
	1st Quarter	1/21/09	13:20	9.41	4.2	6.20	0.50	22.0	8.50	22.0	0.150	clear
	2nd Quarter	4/21/09	14:05	10.57	3.2	6.71	0.21	-37.0	9.87	1.10	1.582	clear
	3rd Quarter	7/21/09	8:24	10.30	3.5	7.03	0.31	-20.1	14.42	0.16	9.234	clear
	4th Quarter	10/19/09	14:11	9.33	1.9	6.37	0.50	-222	16.13	0.63	14.72	clear
	5th Quarter	1/19/10	11:10	7.96	3.5	6.13	5.61	35.5	9.00	7.03	0.498	clear
	6th Quarter	4/20/10	8:35	8.90	1.4	6.05	0.63	108	10.36	1.26	5.271	clear
	7th Quarter	7/20/10	11:55	10.70	2.8	6.08	0.18	-209	15.25	0.23	6.111	clear, colorless, odor
	8th Quarter	10/20/10	12:11	11.60	2.5	6.75	0.50	-47.8	17.32	4.22	6.646	clear
	9th Quarter	1/17/11	13:19	8.42	4.4	6.51	6.03	-23.1	7.39	9.83	0.453	clear
	10th Quarter	4/19/11	14:00	9.80	2.5	6.18	4.53	106	9.34	5.84	0.87	clear
PL2-021A	Baseline	8/27/08	10:13	11.09	4.5	4.02	0.65	931	16.58	8.21	4.026	clear
	1st Quarter	1/21/09	10:25	10.52	7.5	5.20	2.00	-117	13.50	30.0	0.420	amber color
	2nd Quarter	4/20/09	12:04	11.42	4.0	6.07	0.18	-124	14.12	7.85	4.783	clear
	3rd Quarter	7/21/09	11:46	11.01	5.0	8.23	0.11	-129	15.41	8.59	4.520	slightly cloudy
	4th Quarter	10/19/09	12:44	10.27	2.7	5.74	0.69	-108	15.89	2.45	3.902	clear, odor
	5th Quarter	1/18/10	11:15	9.05	0.9	6.16	0.22	-147	14.13	3.43	2.341	clear
	6th Quarter	4/19/10	12:00	9.82	1.5	6.21	0.30	-143	15.90	4.56	3.410	clear
	7th Quarter	7/20/10	15:00	11.58	2.2	6.03	0.12	-155	16.48	4.07	3.357	clear
	8th Quarter	10/20/10	8:41	11.59	2.7	6.34	0.87	-67.3	15.07	6.10	3.067	clear
	9th Quarter	1/18/11	9:15	9.55	2.0	6.59	0.49	-133	13.26	5.49	2.756	clear
	10th Quarter	4/19/11	9:30	10.46	2.0	6.44	0.7	-78.4	11.60	9.73	2.164	clear
PL2-021B	Baseline	9/2/08	9:50	10.84	3.5	5.65	0.17	-124	14.08	8.30	5.637	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	12:44	11.24	2.6	8.26	0.10	-52.0	15.27	1.08	4.926	clear
	4th Quarter	10/22/09	8:51	10.23	3.0	6.75	1.06	-55.6	13.94	1.02	9.293	clear
	5th Quarter	1/18/10	12:16	8.86	3.0	6.81	0.21	-129	13.99	2.56	7.241	clear
	6th Quarter	4/19/10	13:22	9.72	2.0	6.79	0.38	-127	15.34	1.06	6.660	clear
	7th Quarter	7/21/10	9:23	11.68	1.6	6.13	0.16	-164	14.67	4.29	5.367	clear, slightly gray
	8th Quarter	10/20/10	9:29	11.60	1.7	6.26	0.59	-88.2	14.10	3.35	9.369	clear
	9th Quarter	1/18/11	10:37	9.56	1.9	6.66	0.61	-177	12.96	1.25	8.494	clear
	10th Quarter	4/19/11	8:55	10.68	3.4	6.73	0.52	-81.6	13.00	4.08	7.373	clear

Table 1. 2-66 ERD IM Groundwater Field Parameter Summary

Well	Event	Date	Time	Depth to Water (feet)	Total Volume Purged (gallons)	pH	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTUs)	Specific Conductivity (mS/cm)	Comments
PL2-021C	Baseline	9/2/08	10:23	11.15	4.0	5.98	0.13	-215	14.61	9.87	23.94	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	13:20	11.99	2.1	8.79	0.05	-177	15.97	3.79	22.83	clear
	4th Quarter	10/22/09	9:46	10.02	3.0	7.65	0.96	-166	14.62	8.31	22.83	clear
	5th Quarter	1/18/10	12:48	9.02	1.9	7.36	0.21	-208	14.62	0.60	18.21	clear, bubbles
	6th Quarter	4/19/10	14:30	9.55	1.5	7.49	0.27	-237	16.88	3.62	22.66	clear
	7th Quarter	7/21/10	8:33	13.56	2.0	7.46	0.14	-256	15.19	3.53	23.25	clear, bubly
	8th Quarter	10/20/10	10:21	12.90	2.5	7.87	0.45	-167	15.04	3.69	23.07	clear
	9th Quarter	1/18/11	11:11	9.55	1.3	7.96	0.52	-174	13.00	2.87	23.26	clear
	10th Quarter	4/20/11	8:32	10.48	2.2	7.76	0.76	-181	13.88	8.87	23.07	clear
PL2-031A	Baseline	8/27/08	12:45	10.51	3.9	6.91	0.79	-73.2	14.68	6.69	2.002	clear
	1st Quarter	1/21/09	15:10	9.01	2.5	6.90	0.60	-71.0	13.10	3.65	0.220	clear
	2nd Quarter	4/21/09	11:21	10.28	1.9	6.90	0.14	-163	12.60	8.88	2.508	clear
	3rd Quarter	7/21/09	10:05	10.13	2.3	7.77	0.23	-5.10	14.15	0.68	1.901	clear
	4th Quarter	10/19/09	15:54	8.94	2.1	6.75	0.28	-19.6	14.56	9.64	1.960	clear
	5th Quarter	1/20/10	11:11	7.24	1.5	7.32	0.34	-136	13.96	1.51	1.644	clear
	6th Quarter	4/20/10	11:30	8.47	2.0	7.31	6.83	45.0	12.69	1.59	0.690	clear
	7th Quarter	7/21/10	12:58	10.45	2.4	7.07	0.42	-104	15.13	0.81	2.080	clear
	8th Quarter	10/20/10	14:22	10.41	2.5	7.52	0.65	-7.3	16.47	1.79	2.136	clear
	9th Quarter	1/18/11	11:55	8.27	2.0	7.97	0.55	-23.4	13.21	0.33	2.235	clear
	10th Quarter	4/20/11	12:10	9.44	1.6	7.96	0.52	-19.0	11.62	4.89	0.601	clear
PL2-032A	Baseline	8/27/08	8:14	10.86	4.0	4.79	0.67	588	15.68	7.48	2.598	clear
	1st Quarter	1/20/09	11:04	10.21	2.8	6.60	0.80	-103	12.20	14.39	0.260	amber color
	2nd Quarter	4/20/09	10:45	11.22	3.3	6.64	0.28	-121	14.08	7.54	2.624	clear
	3rd Quarter	7/20/09	8:52	10.84	4.0	6.78	0.35	-59.7	15.06	0.61	2.139	clear
	4th Quarter	10/19/09	11:07	10.02	4.3	6.26	0.62	-56.0	15.61	2.63	2.191	clear
	5th Quarter	1/18/10	9:32	8.70	4.0	6.61	0.47	-78.5	13.69	4.25	1.634	clear
	6th Quarter	4/19/10	9:40	9.55	2.2	6.55	0.51	-105	13.65	7.93	2.052	clear
	7th Quarter	7/20/10	10:29	11.36	2.0	6.51	0.30	-132	15.92	0.05	2.168	clear, colorless
	8th Quarter	10/20/10	13:55	11.35	2.0	7.08	0.51	-85.0	17.11	1.24	2.077	clear
	9th Quarter	1/17/11	11:00	9.30	2.6	6.51	0.73	-142	13.09	6.19	1.722	clear
	10th Quarter	4/20/11	11:01	10.35	2.3	7.00	1.22	-56.0	12.02	7.82	2.366	clear
PL2-035A	Baseline	9/2/08	12:55	10.40	6.0	6.31	0.07	-59.2	15.38	8.13	3.221	clear
	1st Quarter	1/20/09	12:49	9.82	2.8	6.60	0.90	-168	14.40	3.36	0.320	clear
	2nd Quarter	4/21/09	9:15	11.08	3.2	6.42	0.18	-119	14.46	9.84	3.824	clear
	3rd Quarter	7/20/09	10:25	10.81	2.0	6.97	0.14	-62.4	15.75	0.96	2.686	clear
	4th Quarter	10/20/09	15:16	9.75	3.3	6.68	0.79	-59.6	15.44	4.19	3.039	clear
	5th Quarter	1/18/10	14:47	8.75	3.0	6.46	0.18	-104	15.15	9.49	2.388	clear
	6th Quarter	4/21/10	9:37	9.29	1.7	6.62	0.30	-116	13.75	2.67	2.887	clear
	7th Quarter	7/21/10	11:57	11.32	1.1	6.36	0.31	-122	16.59	6.43	2.831	clear
	8th Quarter	10/18/10	14:27	11.22	2.5	6.49	0.35	-20.9	16.37	3.14	2.876	clear
	9th Quarter	1/19/11	10:22	9.09	2.5	6.44	0.46	-98.9	15.09	1.53	2.746	clear
	10th Quarter	4/21/11	9:07	10.39	2.2	6.54	0.79	-18.9	13.68	3.69	2.568	clear
PP-1B-I	Baseline	9/3/08	8:46	11.20	3.2	6.88	0.08	110	14.36	7.13	8.568	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	14:03	11.43	2.4	8.20	0.07	-36.5	16.26	1.02	7.495	clear
	4th Quarter	10/21/09	15:49	10.41	2.2	6.99	0.76	-205	14.62	2.99	13.84	clear
	5th Quarter	1/18/10	10:35	9.09	2.0	6.05	0.26	-247	12.67	4.24	11.70	clear, bubbly
	6th Quarter	4/19/10	10:50	9.96	2.0	6.45	1.41	-109	14.36	1.55	13.59	clear
	7th Quarter	7/20/10	14:22	11.83	2.5	6.34	0.16	-230	15.72	0.86	14.02	clear, colorless
	8th Quarter	10/20/10	10:58	11.80	2.5	6.57	0.47	-261	15.28	3.48	12.66	clear
	9th Quarter	1/18/11	8:34	9.73	1.5	6.46	0.74	-161	11.70	5.49	12.66	clear
	10th Quarter	4/19/11	7:43	10.81	3.0	6.59	0.71	-78.2	12.91	12.7	11.87	bubbly, odor
PP-2B-I	Baseline	9/3/08	10:03	10.10	4.5	7.05	0.05	29.9	15.55	9.43	5.037	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	11:04	12.34	2.2	6.96	0.11	-61.7	16.18	8.88	4.296	clear
	4th Quarter	10/20/09	14:17	9.39	3.0	6.98	0.80	-70.0	14.88	4.49	4.178	clear
	5th Quarter	1/19/10	9:33	6.63	2.2	6.74	0.21	-117	14.11	1.24	4.098	clear
	6th Quarter	4/21/10	10:30	8.82	1.9	6.78	0.46	-122	12.90	3.47	6.151	clear
	7th Quarter	7/22/10	10:33	12.56	1.9	6.65	0.27	-137	15.41	2.25	4.913	clear, colorless
	8th Quarter	10/21/10	8:50	12.00	2.2	6.98	1.07	-62.3	14.56	2.85	4.806	clear
	9th Quarter	1/19/11	11:19	8.92	1.5	6.96	0.52	-99.6	13.30	4.27	4.324	clear
	10th Quarter	4/21/11	10:15	12.07	2.7	6.84	0.78	-59.6	13.81	9.29	4.896	clear

Table 1. 2-66 ERD IM Groundwater Field Parameter Summary

Well	Event	Date	Time	Depth to Water (feet)	Total Volume Purged (gallons)	pH	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTUs)	Specific Conductivity (mS/cm)	Comments
PP-2B-O	4th Quarter	10/20/09	13:30	9.04	2.1	6.83	1.06	-49.4	15.24	2.83	3.732	clear, slightly gray
	5th Quarter	1/19/10	8:56	7.44	3.0	6.72	0.34	-110	14.09	2.27	3.021	clear
	6th Quarter	4/21/10	11:11	8.40	1.5	6.73	0.37	-115	12.93	1.75	3.717	clear
	7th Quarter	7/22/10	9:53	13.83	1.8	6.49	0.29	-126	14.99	1.12	3.633	clear, bubbly, colorless
	8th Quarter	10/21/10	8:11	12.81	2.1	6.92	1.08	-49.4	14.50	1.53	3.435	clear
	9th Quarter	1/19/11	10:55	8.82	1.5	6.75	0.50	-96.0	13.79	1.21	3.399	clear
	10th Quarter	4/21/11	11:06	13.86	1.9	7.03	1.03	17.4	14.54	8.62	3.336	clear
PP-3A-I	Baseline	9/2/08	15:15	10.92	4.3	6.05	0.04	-61.6	14.01	7.31	2.722	clear
	1st Quarter	1/21/09	14:25	9.52	2.8	6.40	0.60	7.0	13.80	1.46	0.190	clear
	2nd Quarter	4/21/09	9:56	10.78	2.2	6.29	0.16	-4.9	13.99	4.56	2.692	clear
	3rd Quarter	7/20/09	12:01	10.51	2.0	6.89	0.07	-23.8	14.63	1.75	2.238	clear
	4th Quarter	10/21/09	12:27	9.53	2.1	7.09	0.44	19.5	14.84	1.68	2.129	clear
	5th Quarter	1/19/10	14:00	8.13	2.2	6.95	0.10	-97.3	14.77	1.38	1.748	clear
	6th Quarter	4/22/10	10:06	9.02	1.2	7.06	0.31	-62.6	13.25	1.59	2.289	clear
	7th Quarter	7/21/10	9:59	10.96	1.0	6.72	0.19	-201	14.36	1.36	2.865	clear, slightly gray
	8th Quarter	10/18/10	13:00	10.92	1.7	7.16	0.23	-218	15.72	2.46	2.578	clear
	9th Quarter	1/19/11	8:30	8.82	1.9	6.87	0.65	-71.6	13.56	2.07	2.560	clear
	10th Quarter	4/20/11	13:29	9.98	2.5	7.05	1.09	-60.2	13.68	5.80	3.079	clear
PP-3B-I	Baseline	9/2/08	15:59	11.04	4.5	6.06	0.03	-95.4	14.11	22.70	9.979	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	13:13	10.75	3.3	8.01	0.20	-262	15.12	1.01	9.315	clear
	4th Quarter	10/21/09	13:41	9.44	5.1	7.54	0.35	-285	13.95	0.44	11.32	clear, gray
	5th Quarter	1/20/10	8:44	7.94	4.5	6.91	0.27	-311	13.28	1.70	9.271	clear
	6th Quarter	4/22/10	9:35	8.92	1.9	6.64	0.39	-62.9	13.10	1.21	13.55	clear
	7th Quarter	7/21/10	10:38	11.28	1.4	7.25	0.18	-256	14.73	2.92	11.07	clear, bubbly
	8th Quarter	10/18/10	12:30	11.01	2.2	7.18	0.30	-250	15.01	1.89	13.82	clear
	9th Quarter	1/19/11	9:04	8.77	1.3	6.90	0.55	-207	13.09	5.44	12.20	clear
	10th Quarter	4/20/11	14:00	10.24	1.7	7.26	0.59	-66.9	13.88	9.13	11.19	clear
PP-4B-I	Baseline	9/3/08	11:00	10.25	4.1	6.85	0.06	42.3	16.28	8.68	3.749	clear
	1st Quarter	1/20/09	12:01	9.57	2.2	6.70	0.70	-134	14.00	3.38	0.540	clear
	2nd Quarter	4/21/09	10:45	11.49	2.6	6.96	0.11	-280	16.12	5.41	4.639	clear
	3rd Quarter	7/20/09	9:52	10.80	2.7	7.09	0.28	-52.1	15.83	0.09	2.997	clear
	4th Quarter	10/21/09	9:35	9.45	1.7	6.96	0.64	-60.3	15.43	1.01	3.411	clear
	5th Quarter	1/18/10	13:31	7.70	3.5	6.54	0.15	-112	14.99	0.24	4.204	clear
	6th Quarter	4/21/10	13:25	8.92	2.0	6.81	0.50	-108	13.33	3.43	4.049	clear
	7th Quarter	7/22/10	9:11	12.30	1.0	6.41	0.32	-160	15.73	1.74	4.447	clear, colorless
	8th Quarter	10/21/10	10:10	11.83	2.0	6.84	0.63	-59.0	15.41	2.21	4.366	clear
	9th Quarter	1/19/11	12:11	8.92	2.0	6.76	0.53	-95.4	14.52	1.96	5.079	clear
	10th Quarter	4/18/11	14:14	11.57	2.0	6.77	0.59	-62.6	14.59	NM	4.222	clear
PP-4B-O	4th Quarter	10/21/09	9:03	9.09	2.4	6.76	0.82	-56.9	15.49	1.57	3.455	clear
	5th Quarter	1/18/10	14:01	6.80	1.4	6.51	0.27	-85.8	15.46	1.07	5.253	clear
	6th Quarter	4/21/10	12:21	8.46	1.5	6.82	0.42	-89.1	12.99	3.89	5.306	clear
	7th Quarter	7/22/10	8:35	13.39	1.3	5.68	0.29	-131	15.62	2.17	5.639	clear, colorless
	8th Quarter	10/21/10	9:23	12.51	2.1	6.20	0.70	-45.7	15.32	7.35	4.078	clear
	9th Quarter	1/19/11	12:54	8.75	2.0	6.58	0.43	-118	14.01	2.87	5.09	clear
	10th Quarter	4/18/11	14:47	13.14	2.0	6.76	0.58	-63.0	15.23	1.89	4.366	clear
PP-5B-I	Baseline	9/3/08	12:05	10.50	2.5	6.95	0.02	77.9	14.47	7.92	15.25	clear
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	13:40	10.88	1.5	8.40	0.13	-180	15.09	0.31	0.400	clear
	4th Quarter	10/21/09	14:41	9.50	2.5	8.16	0.42	-170	14.95	0.93	0.492	clear
	5th Quarter	1/19/10	13:01	7.95	5.7	7.01	0.23	-113	14.35	0.68	15.19	clear
	6th Quarter	4/20/10	10:09	9.03	2.5	7.09	3.24	36.6	13.78	1.35	0.252	clear
	7th Quarter	7/20/10	13:33	11.32	2.0	7.03	0.40	-120	15.25	2.41	0.276	clear
	8th Quarter	10/20/10	13:12	11.05	5.0	7.30	1.01	-75.0	15.39	1.13	17.23	clear
	9th Quarter	1/17/11	12:22	8.85	5.8	7.05	0.60	-153	13.99	2.08	12.93	clear
	10th Quarter	4/20/11	10:16	10.12	5.4	7.30	0.42	-70.1	13.20	5.41	17.41	clear

Notes:

°C = degrees Celsius
mg/L = milligrams per liter
mS/cm = milliSiemens per centimeter
mV = millivolt
NM = not measured
NS = not sampled
NTU = nephlometric turbidity units
ORP = oxidation-reduction potential

Table 2. 2-66 ERD IM Ninth Quarter Groundwater Monitoring Analytical Results (January 2011)

Well	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
		PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PL2-041AA	1/18/11	<0.6	56	129	1.0	NS	NS	NS	NS	NS	NS	NS	2.8	43	NS	NS	NS	NS	NS	NS	NS
PL2-008B	1/18/11	<0.2	2.3	2.1	1.8	4.84	NS	NS	NS	NS	NS	NS	<0.5	732	NS	NS	NS	NS	NS	NS	NS
PL2-008C	1/18/11	<0.2	<0.2	<0.2	<0.2	NS	NS	NS	NS	NS	NS	NS	5.0	44	NS	NS	NS	NS	NS	NS	NS
PL2-010A	1/19/11	<4.0	850	150	7.2	8.75	NS	NS	NS	NS	NS	NS	2.8	615	NS	NS	NS	NS	NS	NS	NS
PL2-017A	1/17/11	<0.2	1.2	<0.2	<0.2	3.78	<0.7	<1.2	<1.1	0.137	0.4	19.1	0.4	3	<10 M	<25	ND	<1	0.5 J	<1	1.90 J
PL2-021A	1/18/11	<1.0	8.4	107	64	278	4,330	6.1	1,720	288	<0.1	0.6	17.2	1,430	<10 M	<25 M	ND	420	40	29	212,000
PL2-021A (dup)	1/18/11	<2.0	8.8	110	62	290	4,780	6.7	1,910	288	0.2	<0.1	16.8	1,430	<10 M	<25 M	ND	420	42	25	307,000
PL2-021B	1/18/11	<0.2	0.8	2.5	3.7	8.43	NS	NS	NS	NS	NS	NS	2	553	NS	NS	NS	NS	NS	NS	NS
PL2-021C	1/18/11	<0.2	<0.2	0.3	0.6	48.4	NS	NS	NS	NS	NS	NS	3	352	NS	NS	NS	NS	NS	NS	NS
PL2-031A	1/18/11	<0.2	0.4	0.7	<0.2	5.32	35.3	<1.2	<1.1	0.838	<0.1	58.8	7	97	1.3 JM	<25 M	ND	12	1.4	<1	NS
PL2-032A	1/17/11	<0.2	<0.2	0.6	1.1	11.9	14,600	170	<1.1	30.4	<0.1	8.9	1.8	1,250	<10 M	<25	ND	<1	<1	<1	NS
PL2-035A	1/19/11	<4.0	<4.0	155	620	5.68	26,400	15.2	46.8	44.6	NS	NS	0.8	846	NS	NS	NS	NS	NS	NS	NS
PP-1B-I	1/18/11	<0.2	<0.2	0.5	0.3	1,260	NS	NS	NS	NS	NS	NS	2	1,720	NS	NS	NS	NS	NS	NS	NS
PP-2B-I	1/19/11	<0.2	<0.2	0.6	0.4	3.03	NS	NS	NS	NS	NS	NS	2.4	468	NS	NS	NS	NS	NS	NS	NS
PP-2B-I (dup)	1/19/11	<0.2	<0.2	0.5	0.4	3.00	NS	NS	NS	NS	NS	NS	1	517	NS	NS	NS	NS	NS	NS	NS
PP-2B-O	1/19/11	<0.2	<0.2	0.3	1.8	NS	NS	NS	NS	NS	NS	NS	0.8	742	NS	NS	NS	NS	NS	NS	NS
PP-3A-I	1/19/11	<0.2	0.9	2.4	0.4	6.26	NS	NS	NS	NS	NS	NS	2.0	430	NS	NS	NS	NS	NS	NS	NS
PP-3B-I	1/19/11	<0.2	<0.2	0.4	<0.2	2.56	NS	NS	NS	NS	NS	NS	3	643	NS	NS	NS	NS	NS	NS	NS
PP-4B-I	1/19/11	<0.2	<0.2	0.4	0.4	2.36	NS	NS	NS	NS	NS	NS	1	452	NS	NS	NS	NS	NS	NS	NS
PP-4B-O	1/19/11	<0.2	0.2	0.3	0.3	NS	NS	NS	NS	NS	NS	NS	1	726	NS	NS	NS	NS	NS	NS	NS
PP-5B-I	1/17/11	<0.2	<0.2	2.1	<0.2	2.33	NS	NS	NS	NS	NS	NS	4	278	NS	NS	NS	NS	NS	NS	NS

NOTES:

< = not detected at the reporting limit indicated
J = estimated result
M = recovery/relative percent difference poor for matrix spike/matrix spike duplicate
ND = no data reported
NS = no sample submitted for this analysis

cells/ml = cells per milliliter
mg/L = milligrams per liter
µg/L = micrograms per liter

DCE = sum of cis-1,2-, trans-1,2-, and 1,1-dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene
TOC = total organic carbon
VC = vinyl chloride
VOCs = volatile organic compounds

NO_3 = nitrate ion
SO_4 = sulfate ion

Table 3. 2-66 ERD IM Tenth Quarter Groundwater Monitoring Analytical Results (April 2011)

Well	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
		PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PL2-041AA	4/18/11	<1.0	74	121	2.4	NS	NS	NS	NS	NS	NS	NS	2.5	63	NS	NS	NS	NS	NS	NS	NS
PL2-008B	4/18/11	<0.2	5.0	3.2	2.5	6.53	NS	NS	NS	NS	NS	NS	<0.5	611	NS	NS	NS	NS	NS	NS	NS
PL2-008C	4/18/11	<0.2	<0.2	<0.2	<0.2	NS	NS	NS	NS	NS	NS	NS	2.8	44	NS	NS	NS	NS	NS	NS	NS
PL2-010A	4/21/11	<4.0	730	160	6.2	6.77	NS	NS	NS	NS	NS	NS	0.9	561	NS	NS	NS	NS	NS	NS	NS
PL2-017A	4/19/11	<0.2	1.5	<0.2	<0.2	2.49	<0.7	<1.2	<1.1	0.059	0.3	31.0	0.3	2	<10	<25	ND	<5	<5	<5	23.2
PL2-017 (dup)	4/19/11	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	54.5
PL2-021A	4/19/11	<2.0	5.0	312	390	258	5,530	27.9	2,360	191	<1.0	<1.0	13.5	1,060	<10	<25	ND	230	22	2.6 J	237,000
PL2-021B	4/19/11	<0.2	0.2	0.6	0.8	5.03	NS	NS	NS	NS	NS	NS	1.5	341	NS	NS	NS	NS	NS	NS	NS
PL2-021C	4/20/11	<0.2	<0.2	0.3	0.7	50.0	NS	NS	NS	NS	NS	NS	3	353	NS	NS	NS	NS	NS	NS	NS
PL2-031A	4/20/11	<0.2	20	4.7	<0.2	1.89	<0.7	<1.2	<1.1	0.047	0.2	16.9	1.7	<1	<10 M	<25	ND	<5	<5	<5	NS
PL2-032A	4/20/11	<0.2	<0.2	0.3	1.0	11.6	15,200	143	<1.1	26.8	0.1	0.5	0.6	1,190	<10 M	<25	ND	<5	<5	<5	NS
PL2-032A (dup)	4/20/11	<0.2	<0.2	0.3	0.9	11.7	14,700	137	<1.1	26.8	<0.1	0.5	0.6	1,140	<10 M	<25	ND	<5	<5	<5	NS
PL2-035A	4/21/11	<10	<10	410	900	5.90	9,030	3.0	18.9	36.9	NS	NS	<1	921	NS	NS	NS	NS	NS	NS	NS
PP-1B-I	4/19/11	<0.2	<0.2	<0.2	<0.2	364	NS	NS	NS	NS	NS	NS	<1	1,110	NS	NS	NS	NS	NS	NS	NS
PP-2B-I	4/21/11	<0.2	0.2	0.3	0.5	2.65	NS	NS	NS	NS	NS	NS	1	656	NS	NS	NS	NS	NS	NS	NS
PP-2B-I (dup)	4/21/11	<0.2	<0.2	0.3	0.4	2.55	NS	NS	NS	NS	NS	NS	<1	606	NS	NS	NS	NS	NS	NS	NS
PP-2B-O	4/21/11	<0.2	<0.2	0.2	1.0	NS	NS	NS	NS	NS	NS	NS	<1	741	NS	NS	NS	NS	NS	NS	NS
PP-3A-I	4/20/11	<0.2	0.9	6.9	3.0	5.28	NS	NS	NS	NS	NS	NS	1.3	711	NS	NS	NS	NS	NS	NS	NS
PP-3B-I	4/20/11	<0.2	0.3	24	2.5	2.91	NS	NS	NS	NS	NS	NS	2	619	NS	NS	NS	NS	NS	NS	NS
PP-4B-I	4/18/11	<0.2	<0.2	0.3	0.3	3.64	NS	NS	NS	NS	NS	NS	<0.5	298	NS	NS	NS	NS	NS	NS	NS
PP-4B-O	4/18/11	<0.2	<0.2	0.4	0.4	NS	NS	NS	NS	NS	NS	NS	<0.5	455	NS	NS	NS	NS	NS	NS	NS
PP-5B-I	4/20/11	<0.2	<0.2	1.7	<0.2	1.94	NS	NS	NS	NS	NS	NS	<1	274	NS	NS	NS	NS	NS	NS	NS

NOTES:

< = not detected at the reporting limit indicated
J = estimated result
M = recovery/relative percent difference poor for matrix spike/matrix spike duplicate
ND = no data reported
NS = no sample submitted for this analysis

cells/ml = cells per milliliter
mg/L = milligrams per liter
µg/L = micrograms per liter

DCE = sum of cis-1,2-, trans-1,2-, and 1,1-dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene
TOC = total organic carbon
VC = vinyl chloride
VOCs = volatile organic compounds

NO_3 = nitrate ion
SO_4 = sulfate ion

Table 4. 2-66 ERD IM Groundwater Monitoring Analytical Data Summary

Well	Event	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
			PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PL2-041AA	4th Quarter	10/20/09	<1.2	220	277	4.0	NS	NS	NS	NS	NS	NS	NS	4.1	48	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/20/10	<2.0	91	214	3.1	NS	NS	NS	NS	NS	NS	NS	3.7	53	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/20/10	<0.2	83	181	2.6	NS	NS	NS	NS	NS	NS	NS	2.6	56	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<1.0	85	127	1.6	NS	NS	NS	NS	NS	NS	NS	2.2	60	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/20/10	<0.2	61	140	1.0	NS	NS	NS	NS	NS	NS	NS	2.5	62	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.6	56	129	1.0	NS	NS	NS	NS	NS	NS	NS	2.8	43	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/18/11	<1.0	74	121	2.4	NS	NS	NS	NS	NS	NS	NS	2.5	63	NS	NS	NS	NS	NS	NS	NS
PL2-008B	Baseline	9/2/08	<1.0	<1.0	5.8	46	3.07	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	0.2	1.3	2.9	5.45	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	0.2	1.2	2.9	5.45	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/20/09	<0.2	0.4	1.1	1.9	3.59	NS	NS	NS	NS	NS	NS	0.6	724	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/20/10	<0.2	0.3	0.6	1.2	2.77	NS	NS	NS	NS	NS	NS	<0.5	860	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<0.2	0.5	0.7	1.6	2.08	NS	NS	NS	NS	NS	NS	<1	510	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	2.0	2.1	4.7	676	NS	NS	NS	NS	NS	NS	<2	2,740	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	2.0	2.0	4.8	710	NS	NS	NS	NS	NS	NS	<2	2,940	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	<0.2	1.6	2.0	1.5	10.2	NS	NS	NS	NS	NS	NS	<0.5	792	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	<0.2	1.6	2.0	1.6	9.23	NS	NS	NS	NS	NS	NS	<0.5	797	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.2	2.3	2.1	1.8	4.84	NS	NS	NS	NS	NS	NS	<0.5	732	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/18/11	<0.2	5.0	3.2	2.5	6.53	NS	NS	NS	NS	NS	NS	<0.5	611	NS	NS	NS	NS	NS	NS	NS
PL2-008C	4th Quarter	10/20/09	<0.2	<0.2	0.4	0.9	NS	NS	NS	NS	NS	NS	NS	1	45	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/20/10	<0.2	<0.2	<0.2	0.2	NS	NS	NS	NS	NS	NS	NS	3.1	49	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/20/10	<0.2	<0.2	<0.2	<0.2	NS	NS	NS	NS	NS	NS	NS	2	46	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	<0.2	0.3	<0.2	NS	NS	NS	NS	NS	NS	NS	2	46	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/21/10	<0.2	<0.2	0.7	0.7	NS	NS	NS	NS	NS	NS	NS	2.7	48	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.2	<0.2	<0.2	<0.2	NS	NS	NS	NS	NS	NS	NS	5.0	44	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/18/11	<0.2	<0.2	<0.2	<0.2	NS	NS	NS	NS	NS	NS	NS	2.8	44	NS	NS	NS	NS	NS	NS	NS
PL2-010A	Baseline	9/2/08	<5.0	590	107	<5.0	<1.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<5.0	860	89	<5.0	1.88	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<6.0	520	86	6.6	<1.50	NS	NS	NS	NS	NS	NS	<0.5	747	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/19/10	<4.0	270	530	250	2.82	NS	NS	NS	NS	NS	NS	0.6	1,380	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/22/10	<3.0	90	1,719	660	<1.50	NS	NS	NS	NS	NS	NS	<0.5	1,090	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<5.0	620	280	42	2.38	NS	NS	NS	NS	NS	NS	<0.5	546	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	0.4	920	338	60	8.80	NS	NS	NS	NS	NS	NS	1.5	138	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<4.0	850	150	7.2	8.75	NS	NS	NS	NS	NS	NS	2.8	615	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/21/11	<4.0	730	160	6.2	6.77	NS	NS	NS	NS	NS	NS	0.9	561	NS	NS	NS	NS	NS	NS	NS
PL2-017A	Baseline	8/27/08	<0.2	1.6	0.3	<0.2	1.66	3.5	<1.2	<1.1	6.84	<10.0	655	<2	126	<4	<1	<1	<1	<1	<1	3.99
	Baseline	8/27/08	<0.2	1.5	0.2	<0.2	1.51	3.1	<1.2	<1.1	6.84	<10.0	655	<2	125	<4	<1	<1	<1	<1	<1	NS
	1st Quarter	1/21/09	<0.2	2.1	0.2	<0.2	3.34	6.9	<1.2	<1.1	1.50	<0.1	52.7	<0.5	16	<4	<1	<1	<1	<1	<1	NS
	2nd Quarter	4/20/00	<0.2	0.7	<0.2	<0.2	3.39	<0.7	<1.2	<1.1	0.51	<0.1	49.5	0.5	6	<4	<1	<1	<1	<1	<1	NS
	3rd Quarter	7/21/09	<0.2	0.6	<0.2	<0.2	<1.50	4.6	<1.2	<1.1	3.98	<0.2	403	<1	102	<10	<25	ND	<1	<1	<1	18.6
	3rd Quarter	7/21/09	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	7.70
	4th Quarter	10/19/09	<0.2	0.9	0.2	<0.2	1.94	9.7	<1.2	<1.1	0.702	<1.0	576	<1	30	<0.070 M	0.066 J	ND	0.050 J	<0.070	<0.070	17.5
	4th Quarter	10/19/09	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	3.50
	5th Quarter	1/19/10	<0.2	2.0	<0.2	<0.2	2.61	<0.7	<1.2	<1.1	0.117	1.8	33.4	0.6	3	<10	<25	ND	<1	<1	<1	6.30
	5th Quarter	1/19/10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2.50
	6th Quarter	4/20/10	<0.2	1.9	<0.2	<0.2	<1.50	<0.7	<1.2	<1.1	0.703	<0.1	216	<1	14	<10	<25 M	ND	<1.0	<1.0	<1.0	3.80
	6th Quarter	4/20/10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.50
	7th Quarter	7/20/10	<0.2	1.5	<0.2	<0.2	8.84	6.9	<1.2	<1.1	5.94	<0.1	233	<0.5	54	<10 M	<25	ND	<1.0	<1.0	<1.0	15.6
	7th Quarter	7/20/10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	7.60
	8th Quarter	10/20/10	<0.2	2.3	0.2	<0.2	2.35	52.2	<1.2	<1.1	1.73	<0.1	223	2	42	<10	<25 M	ND	<1.0	<1.0	<1.0	1.60
	8th Quarter	10/20/10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2.25
	9th Quarter	1/17/11	<0.2	1.2	<0.2	<0.2	3.78	<0.7	<1.2	<1.1	0.137	0.4	19.1	0.4	3	<10 M	<25	ND	<1.0	0.5 J	<1.0	1.90 J
	10th Quarter	4/19/11	<0.2	1.5	<0.2	<0.2	2.49	<0.7	<1.2	<1.1	0.059	0.3	31.0	0.3	2	<10	<25	ND	<5	<5	<5	23.2
	10th Quarter	4/19/11	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	54.5

Table 4. 2-66 ERD IM Groundwater Monitoring Analytical Data Summary

Well	Event	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
			PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PL2-021A	Baseline	8/27/08	4.0	2,700	870	35	9.40	6.6	<1.2	1.2	96.0	<5.0	73.0	0.9	2,840	<4	<1	<1	<1	<1	<1	0.245 J
	1st Quarter	1/21/09	<300	310	3,800	<300	680	25.3	<1.2	2.6	560	<0.5	110	8.6	2,240	<4	33.1	2.4	346.9	43.3	501.6	NS
	2nd Quarter	4/20/09	<0.2	14	5,013	22	542	15.7	<1.2	<1.1	505	<0.5	1.3	15.9	2,250	<4	<1	<1	396.4	68.3	318.7	NS
	3rd Quarter	7/21/09	<20	<20	4,720	360	530	190	<1.2	10.2	479	<1.0	<0.5	14.0	1,930	<10	9.6	ND	380	66	260	6,800
	4th Quarter	10/19/09	<20	<20	1,000	11,000	473	253	<1.2	76.5	396	<0.5	0.8	13.2	1,530	6.6	2.2	ND	410	60	220	372,000
	5th Quarter	1/18/10	<20	<20	410	3,800	372	2,730	<1.2	433	406	<0.1	<1.0	15.1	1,560	28 J	<120	ND	750	100	110	2,200,000
	6th Quarter	4/19/10	<6.0	<6.0	256	730	290	6,230	<1.2	2,530	382	<1.0	<1.0	13.7	1,710	<10	<25 M	ND	430	75	43	6,840
	7th Quarter	7/20/10	<0.2	1.1	45	310	418	3,940	<1.2	2,500	358	<0.1	<0.5	16	1,760	<10 M	<25	ND	440	74	57	1,200,000
	8th Quarter	10/20/10	<3.0	<3.0	43	150	362	3,300	<1.2	1,710	336	<0.1	1.2	15.2	1,830	<10	<25 M	ND	500	61	43	72,500
	9th Quarter	1/18/11	<1.0	8.4	107	64	278	4,330	6.1	1,720	288	<0.1	0.6	17.2	1,430	<10 M	<25 M	ND	420	40	29	212,000
	9th Quarter	1/18/11	<2.0	8.8	110	62	290	4,780	6.7	1,910	288	0.2	<0.1	16.8	1,430	<10 M	<25 M	ND	420	42	25	307,000
	10th Quarter	4/19/11	<2.0	5.0	312	390	258	5,530	27.9	2,360	191	<1.0	<1.0	13.5	1,060	<10	<25	ND	230	22	2.6 J	237,000
PL2-021B	Baseline	9/2/08	<0.2	<0.2	1.2	0.6	3.21	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	<0.2	<0.2	3.4	3.0	14.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/22/09	<0.2	<0.2	0.8	0.5	<1.50	NS	NS	NS	NS	NS	NS	<1	481	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	1.0	0.3	3.50	NS	NS	NS	NS	NS	NS	0.8	268	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/19/10	<0.2	<0.2	0.8	0.5	2.22	NS	NS	NS	NS	NS	NS	<0.5	231	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	2.4	6.4	3.6	200	NS	NS	NS	NS	NS	NS	<0.5	365	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/20/10	<0.2	0.7	7.4	7.8	37.9	NS	NS	NS	NS	NS	NS	1	702	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.2	0.8	2.5	3.7	8.43	NS	NS	NS	NS	NS	NS	2	553	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/19/11	<0.2	0.2	0.6	0.8	5.03	NS	NS	NS	NS	NS	NS	1.5	341	NS	NS	NS	NS	NS	NS	NS
PL2-021C	Baseline	9/2/08	<0.2	<0.2	0.3	0.4	48.8	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	<0.2	<0.2	<0.2	0.7	43.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/22/09	<0.2	<0.2	<0.2	0.7	46.4	NS	NS	NS	NS	NS	NS	<2	359	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	<0.2	0.7	48.6	NS	NS	NS	NS	NS	NS	4	354	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/19/10	<0.2	<0.2	0.2	0.5	34.0	NS	NS	NS	NS	NS	NS	2	389	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	<0.2	<0.2	0.4	48.4	NS	NS	NS	NS	NS	NS	<2	399	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/20/10	<0.2	<0.2	<0.2	0.4	56.0	NS	NS	NS	NS	NS	NS	3	355	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.2	<0.2	0.3	0.6	48.4	NS	NS	NS	NS	NS	NS	3	352	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/20/11	<0.2	<0.2	0.3	0.7	50.0	NS	NS	NS	NS	NS	NS	3	353	NS	NS	NS	NS	NS	NS	NS
PL2-031A	Baseline	8/27/08	<0.2	3.0	1.3	2.1	5.92	12.1	<1.2	<1.1	1.03	<1.0	73.7	NS	NS	<4	<1	<1	<1	<1	<1	NS
	1st Quarter	1/21/09	<0.2	2.0	2.3	1.5	6.26	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/21/09	<0.2	5.9	1.1	3.5	6.50	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	<0.2	7.2	2.8	<0.2	7.39	11.8	<1.2	<1.1	1.91	<0.1	64.5	NS	NS	<10	2.4	ND	<1	<1	<1	NS
	4th Quarter	10/19/09	<0.2	1.2	1.7	0.5	5.86	32.8	<1.2	<1.1	0.878	<0.5	75.5	7.0	65	<0.070 M	0.091 J	ND	0.030 J	<0.070	<0.070	NS
	4th Quarter	10/19/09	<0.2	1.0	1.5	0.6	6.11	39.0	<1.2	<1.1	0.907	<0.5	74.6	7.3	65	<0.070 M	0.087 J	ND	0.038 J	<0.070	<0.070	NS
	5th Quarter	1/20/10	<0.2	0.4	0.9	0.2	8.43	285	<1.2	<1.1	0.677	<0.1	82.6	6.9	70	<10	<25	ND	<1.0	<1.0	<1.0	NS
	5th Quarter	1/20/10	<0.2	0.3	0.9	0.2	8.38	291	<1.2	<1.1	0.685	<0.1	78.8	7.5	70	<10	<25	ND	<1.0	<1.0	<1.0	NS
	6th Quarter	4/20/10	<0.2	3.7	1.0	<0.2	4.12	14.7	<1.2	<1.1	0.674	<0.1	70.8	4	75	<10	<25 M	ND	<1.0	<1.0	<1.0	NS
	6th Quarter	4/20/10	<0.2	3.7	1.0	<0.2	4.16	15.2	<1.2	<1.1	0.631	<0.1	69.3	4	75	<10	2.6 JM	ND	<1.0	<1.0	<1.0	NS
	7th Quarter	7/21/10	<0.2	0.6	0.4	2.6	6.35	7.1	<1.2	<1.1	2.72	<0.1	79.3	9	101	<10 M	<25	ND	<1.0	<1.0	0.8 J	NS
	8th Quarter	10/20/10	<0.2	6.8	1.4	<0.2	6.48	7.2	<1.2	<1.1	1.60	<0.1	86.9	5.4	100	<10	<25 M	ND	<1.0	<1.0	1.1	NS
	9th Quarter	1/18/11	<0.2	0.4	0.7	<0.2	5.32	35.3	<1.2	<1.1	0.838	<0.1	58.8	7	97	1.3 JM	<25 M	ND	12	1.4	<1.0	NS
	10th Quarter	4/20/11	<0.2	20	4.7	<0.2	1.89	<0.7	<1.2	>1.1	0.047	0.2	16.9	1.7	<1	<10 M	<25	ND	<5	<5	<5	NS
PL2-032A	Baseline	8/27/08	<10	<10	<10	900	10.8	3,190	295	557	28.6	<1.0	6.3	NS	NS	<4	<1	<1	<1	<1	<1	88.3
	1st Quarter	1/20/09	<0.2	<0.2	1.0	41	13.9	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	1/20/09	<1.0	<1.0	<1.0	43	12.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/20/09	<0.2	<0.2	0.6	13	23.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/20/09	<0.2	<0.2	0.6	13	20.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	<0.2	0.6	11	15.6	3,170	317	466	32.2	<0.1	0.2	NS	NS	<10	<25	ND	<1	<1	<1	NS
	3rd Quarter	7/20/09	<0.2	<0.2	0.6	11	17.5	3,120	285	429	31.4	<0.1	0.2	NS	NS	<10	<25	ND	<1	<1	<1	NS
	4th Quarter	10/19/09	<0.2	<0.2	0.9	14	14.4	4,380	306	323	30.3	<0.1	0.7	1.4	1,370	<0.070 M	0.100 J	ND	0.020 J	<0.070	<0.070	NS
	5th Quarter	1/18/10	<0.2	<0.2	0.6	3.0	14.4	10,400	332	24.7	22.4	<0.1	0.3	1.5	1,280	<10	<25	ND	<1	<1	<1	NS
	6th Quarter	4/19/10	<0.2	<0.2	0.4	1.3	9.54	11,700	296	<1.1	26.0	<1.0	1.9	0.9	1,290	2.0 J	<25 M	ND	<1.0	<1.0	<1.0	NS
	7th Quarter	7/20/10	<0.2	<0.2	0.4	1.6	12.9	6,920	227	1.2	35.4	<0.1	9.2	1.5	1,300	<10 M	<25	ND	<1.0	<1.0	0.8 J	NS
	7th Quarter	7/20/10	<0.2	<0.2	0.4	1.6	14.0	7,150	225	1.2	35.8	<0.1	9.5	<0.5	1,320	<10 M	<25	ND	<1.0	<1.0	<1.0	NS
	8th Quarter	10/20/10	<0.2	<0.2	0.7	2.3	11.3	5,920	168	4.0	0.59	<0.1	14.9	0.6	1,280	<10	<25 M	ND	0.6 J	<1.0	<1.0	NS
	8th Quarter	10/20/10	<0.2	<0.2	0.7	2.1	11.9	5,860	164	3.7	0.59	<0.1	13.8	0.7	1,240	1.3 J	<25 M	ND	<1.0	<1.0	<1.0	NS
	9th Quarter	1/17/11	<0.2	<0.2	0.6	1.1	11.9	14,600	170	<1.1	30.4	<0.1	8.9	1.8	1,250	<10 M	<25	ND	<1.0	<1.0	<1.0	NS
	10th Quarter	4/20/11	<0.2	<0.2	0.3	1.0	11.6	15,200	143	<1.1	26.8	0.1	0.5	0.6	1,190	<10 M	<25	ND	<5	<5	<5	NS
	10th Quarter	4/20/11	<0.2	<0.2	0.3	0.9	11.7	14700	137	<1.1	26.8	<0.1	0.5	0.6	1,140	<10 M	<25	ND	<5	<5	<5	NS

Table 4. 2-66 ERD IM Groundwater Monitoring Analytical Data Summary

Well	Event	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
			PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PL2-035A	Baseline	9/2/08	<100	<100	10,000	2,900	4.63	745	9.0	43.5	8.20	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	1/20/09	<250	<250	7,200	6,200	7.74	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/21/09	<0.2	4.2	9,950	6,200	6.04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<100	<100	6,400	3,000	6.84	9,080	44.5	225	50.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/20/09	<12	<12	2,124	2,800	3.98	10,300	41.2	230	41.8	NS	NS	0.7	1,390	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<20	<20	2,224	2,500	7.31	16,900	31.5	209	52.0	NS	NS	0.9	1,250	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<20	<20	1,822	2,700	4.17	14,800	35.0	273	55.5	NS	NS	<1	1,260	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<10	<10	1,115	1,600	5.36	16,100	42.0	107	44.8	NS	NS	2	1,170	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	<0.2	0.9	260	760	5.33	15,200	20.1	32.5	46.6	NS	NS	1.0	1,010	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<4.0	<4.0	155	620	5.68	26,400	15.2	46.8	44.6	NS	NS	0.8	846	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/21/11	<10	<10	410	900	5.90	9,030	3.0	18.9	36.9	NS	NS	<1	921	NS	NS	NS	NS	NS	NS	NS
PP-1B-I	Baseline	9/3/08	<0.2	<0.2	1.0	<0.2	3.12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/21/09	<0.2	0.3	1.3	<0.2	4.94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<0.2	<0.2	12	3.0	78.0	NS	NS	NS	NS	NS	NS	<2	1,210	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<0.2	<0.2	13	4.0	77.6	NS	NS	NS	NS	NS	NS	<2	1,180	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	6.2	2.5	8.78	NS	NS	NS	NS	NS	NS	2.5	1,950	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	6.1	2.4	9.20	NS	NS	NS	NS	NS	NS	1.9	1,930	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/19/10	<0.2	<0.2	0.3	<0.2	5.20	NS	NS	NS	NS	NS	NS	<1	2,050	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/19/10	<0.2	<0.2	0.3	<0.2	4.90	NS	NS	NS	NS	NS	NS	1.4	2,010	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/20/10	<0.2	<0.2	0.6	<0.2	212	NS	NS	NS	NS	NS	NS	<2	796	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/20/10	<0.2	<0.2	0.7	<0.2	168	NS	NS	NS	NS	NS	NS	<2	995	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/18/11	<0.2	<0.2	<0.2	0.3	1,260	NS	NS	NS	NS	NS	NS	2	1,720	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/19/11	<0.2	<0.2	<0.2	<0.2	364	NS	NS	NS	NS	NS	NS	<1	1,110	NS	NS	NS	NS	NS	NS	NS
PP-2B-I	Baseline	9/3/08	<0.2	0.3	6.6	140	1.76	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	<0.2	0.4	1.4	136	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/20/09	<0.2	0.4	0.3	1.1	18.2	NS	NS	NS	NS	NS	NS	<0.5	397	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/19/10	<0.2	<0.2	0.2	0.4	7.50	NS	NS	NS	NS	NS	NS	0.6	786	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<0.2	<0.2	0.3	0.6	1.79	NS	NS	NS	NS	NS	NS	<1	784	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/22/10	<0.2	<0.2	0.3	0.6	2.58	NS	NS	NS	NS	NS	NS	<1	477	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/21/10	<0.2	<0.2	<0.2	0.2	3.94	NS	NS	NS	NS	NS	NS	0.6	531	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.6	0.4	3.03	NS	NS	NS	NS	NS	NS	2.4	468	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.5	0.4	3.00	NS	NS	NS	NS	NS	NS	1	517	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/21/11	<0.2	0.2	0.3	0.5	2.65	NS	NS	NS	NS	NS	NS	1	656	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/21/11	<0.2	<0.2	0.3	0.4	2.55	NS	NS	NS	NS	NS	NS	<1	606	NS	NS	NS	NS	NS	NS	NS
PP-2B-O	4th Quarter	10/20/09	<0.2	<0.2	0.5	39	NS	NS	NS	NS	NS	NS	NS	<0.5	597	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/19/10	<0.2	<0.2	<0.2	0.2	NS	NS	NS	NS	NS	NS	NS	0.6	710	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<0.2	<0.2	<0.2	0.5	NS	NS	NS	NS	NS	NS	NS	<1	792	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/22/10	<0.2	<0.2	0.3	1.0	NS	NS	NS	NS	NS	NS	NS	<1	738	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/21/10	<0.2	<0.2	0.3	1.6	NS	NS	NS	NS	NS	NS	NS	<0.5	770	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.3	1.8	NS	NS	NS	NS	NS	NS	NS	0.8	742	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/21/11	<0.2	<0.2	0.2	1.0	NS	NS	NS	NS	NS	NS	NS	<1	741	NS	NS	NS	NS	NS	NS	NS
PP-3A-I	Baseline	9/2/08	<0.2	1.6	19.4	0.8	3.29	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	1/21/09	<0.2	4.2	11.2	0.7	3.78	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/21/09	<0.2	2.6	5.4	0.5	4.73	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	2.0	4.9	2.2	5.52	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<0.2	2.0	12.1	0.2	4.76	NS	NS	NS	NS	NS	NS	2.7	321	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/19/10	<0.2	2.3	4.5	<0.2	5.96	NS	NS	NS	NS	NS	NS	3.8	346	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/22/10	<0.2	2.1	5.7	0.4	3.13	NS	NS	NS	NS	NS	NS	1.3	400	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	1.5	21.8	20	29.0	NS	NS	NS	NS	NS	NS	<2	605	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	<0.2	0.6	3.2	0.9	28.4	NS	NS	NS	NS	NS	NS	2.7	623	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	0.9	2.4	0.4	6.26	NS	NS	NS	NS	NS	NS	2.0	430	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/20/11	<0.2	0.9	6.9	3.0	5.28	NS	NS	NS	NS	NS	NS	1.3	711	NS	NS	NS	NS	NS	NS	NS

Table 4. 2-66 ERD IM Groundwater Monitoring Analytical Data Summary

Well	Event	Date	Chlorinated VOCs (µg/L)				TOC (mg/L)	Dissolved Gases (µg/L)			Ferrous Iron (mg/L)	Anions (mg/L)		Metals (µg/L)		Organic Acids (mg/L)						Bacterial Census (cells/ml)
			PCE	TCE	DCE	VC		Methane	Ethane	Ethene		NO_3	SO_4	Arsenic	Manganese	Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric	
PP-3B-I	Baseline	9/2/08	<0.2	2.0	1.2	<0.2	2.14	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	1.4	3.5	2.6	164	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<0.2	0.6	1.5	1.3	48.0	NS	NS	NS	NS	NS	NS	<1	553	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/20/10	<0.2	<0.2	0.5	0.4	7.94	NS	NS	NS	NS	NS	NS	1.4	466	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/22/10	<0.2	<0.2	0.5	<0.2	1.60	NS	NS	NS	NS	NS	NS	<1	833	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/21/10	<0.2	<0.2	1.5	1.5	2.61	NS	NS	NS	NS	NS	NS	<1	737	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/18/10	<0.2	<0.2	0.5	<0.2	8.22	NS	NS	NS	NS	NS	NS	2	409	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.4	<0.2	2.56	NS	NS	NS	NS	NS	NS	3	643	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/20/11	<0.2	0.3	24	2.5	2.91	NS	NS	NS	NS	NS	NS	2	619	NS	NS	NS	NS	NS	NS	NS
PP-4B-I	Baseline	9/3/08	<0.2	5.9	1,300	830	1.97	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	1/20/09	<1.0	<1.0	17	51	41.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	4/21/09	<0.2	2.5	37	120 E	84.8	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<10	<10	150	360	3.81	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<1.0	<1.0	70	130	3.27	NS	NS	NS	NS	NS	NS	<0.5	548	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	11.2	27	4.70	NS	NS	NS	NS	NS	NS	<0.5	714	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<0.2	<0.2	0.4	1.6	1.79	NS	NS	NS	NS	NS	NS	<1	431	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/22/10	<0.2	<0.2	<0.2	<0.2	43.4	NS	NS	NS	NS	NS	NS	<1	709	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/21/10	<0.2	<0.2	0.3	0.2	15.3	NS	NS	NS	NS	NS	NS	<0.5	545	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.4	0.4	2.36	NS	NS	NS	NS	NS	NS	1	452	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/18/11	<0.2	<0.2	0.3	0.3	3.64	NS	NS	NS	NS	NS	NS	<0.5	298	NS	NS	NS	NS	NS	NS	NS
PP-4B-O	4th Quarter	10/21/09	<0.2	2	14	45	NS	NS	NS	NS	NS	NS	NS	<0.5	217	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/18/10	<0.2	<0.2	1.7	6.2	NS	NS	NS	NS	NS	NS	NS	0.7	710	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/21/10	<0.2	<0.2	0.8	2.4	NS	NS	NS	NS	NS	NS	NS	<1	392	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/22/10	<0.2	0.2	0.9	1.4	NS	NS	NS	NS	NS	NS	NS	<1	1,370	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/21/10	<0.2	<0.2	4.6	20	NS	NS	NS	NS	NS	NS	NS	<0.5	1,210	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/19/11	<0.2	<0.2	0.3	0.3	NS	NS	NS	NS	NS	NS	NS	1	726	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/18/11	<0.2	<0.2	0.4	0.4	NS	NS	NS	NS	NS	NS	NS	<0.5	455	NS	NS	NS	NS	NS	NS	NS
PP-5B-I	Baseline	9/3/08	<0.2	0.4	4.9	<0.2	1.77	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Baseline	9/3/08	<0.2	0.4	4.8	<0.2	1.78	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1st Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2nd Quarter	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3rd Quarter	7/20/09	<0.2	0.3	0.7	<0.2	3.59	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4th Quarter	10/21/09	<0.2	0.3	1.0	<0.2	<1.50	NS	NS	NS	NS	NS	NS	<0.5	56	NS	NS	NS	NS	NS	NS	NS
	5th Quarter	1/19/10	<0.2	0.2	2.3	<0.2	4.76	NS	NS	NS	NS	NS	NS	2	512	NS	NS	NS	NS	NS	NS	NS
	6th Quarter	4/20/10	<0.2	<0.2	0.6	<0.2	<1.50	NS	NS	NS	NS	NS	NS	0.2	23	NS	NS	NS	NS	NS	NS	NS
	7th Quarter	7/20/10	<0.2	<0.2	0.2	<0.2	<1.50	NS	NS	NS	NS	NS	NS	0.7	227	NS	NS	NS	NS	NS	NS	NS
	8th Quarter	10/20/10	<0.2	<0.2	2.8	<0.2	2.27	NS	NS	NS	NS	NS	NS	<2	323	NS	NS	NS	NS	NS	NS	NS
	9th Quarter	1/17/11	<0.2	<0.2	2.1	<0.2	2.33	NS	NS	NS	NS	NS	NS	4	278	NS	NS	NS	NS	NS	NS	NS
	10th Quarter	4/20/11	<0.2	<0.2	1.7	<0.2	1.94	NS	NS	NS	NS	NS	NS	<1	274	NS	NS	NS	NS	NS	NS	NS

NOTES:

< = not detected at the value indicated
E = value greater than the linear range of the detector; sample dilution required
J = estimated result
M = recovery/relative percent difference poor for matrix spike/matrix spike duplicate
ND = no data reported
NS = no sample submitted for this analysis

cells/ml = cells per milliliter
mg/L = milligrams per liter
µg/L = micrograms per liter

DCE = sum of cis-1,2-, trans-1,2-, and 1,1-dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene
TOC = total organic carbon
VC = vinyl chloride
VOCs = volatile organic compounds

NO_3 = nitrate ion
SO_4 = sulfate ion

Table 5. 2-66 ERD IM Overall Performance Summary

Well	Event	Date	Chlorinated VOCs (µg/L)				TOTAL Chlorinated VOCs (µg/L)	Percent Reduction in Total Chlorinated VOCs
			PCE	TCE	DCE	VC		
PL2-041AA	4th Quarter	10/20/09	<1.2	220	277	4.0	501	61
	10th Quarter	4/18/11	<1.0	74	121	2.4	197.4	
PL2-008B	Baseline	9/2/08	<1.0	<1.0	5.8	46	51.8	79
	10th Quarter	4/18/11	<0.2	5.0	3.2	2.5	10.7	
PL2-008C	4th Quarter	10/20/09	<0.2	<0.2	0.4	0.9	1.3	100
	10th Quarter	4/18/11	<0.2	<0.2	<0.2	<0.2	0	
PL2-010A	Baseline	9/2/08	<5.0	590	107	<5.0	697	-29
	10th Quarter	4/21/11	<4.0	730	160	6.2	896	
PL2-017A	Baseline	8/27/08	<0.2	1.6	0.3	<0.2	1.8	17
	Baseline	8/27/08	<0.2	1.5	0.2	<0.2		
	10th Quarter	4/19/11	<0.2	1.5	<0.2	<0.2	1.5	
PL2-021A	Baseline	8/27/08	4.0	2,700	870	35	3,609	80
	10th Quarter	4/19/11	<2.0	5.0	312	390	707	
PL2-021B	Baseline	9/2/08	<0.2	<0.2	1.2	0.6	1.8	11
	10th Quarter	4/19/11	<0.2	0.2	0.6	0.8	1.6	
PL2-021C	Baseline	9/2/08	<0.2	<0.2	0.3	0.4	0.7	-43
	10th Quarter	4/20/11	<0.2	<0.2	0.3	0.7	1.0	
PL2-031A	Baseline	8/27/08	<0.2	3.0	1.3	2.1	6.4	83
	9th Quarter	1/18/11	<0.2	0.4	0.7	<0.2	1.1	
PL2-032A	Baseline	8/27/08	<10	<10	<10	900	900	>99
	10th Quarter	4/20/11	<0.2	<0.2	0.3	1.0	1.3	
	10th Quarter	4/20/11	<0.2	<0.2	0.3	0.9		
PL2-035A	Baseline	9/2/08	<100	<100	10,000	2,900	12,900	90
	10th Quarter	4/21/11	<10	<10	410	900	1,310	
PP-1B-I	Baseline	9/3/08	<0.2	<0.2	1.0	<0.2	1.0	100
	10th Quarter	4/19/11	<0.2	<0.2	<0.2	<0.2	0	
PP-2B-I	Baseline	9/3/08	<0.2	0.3	6.6	140	146.9	99
	10th Quarter	4/21/11	<0.2	0.2	0.3	0.5	0.85	
	10th Quarter	4/21/11	<0.2	<0.2	0.3	0.4		
PP-2B-O	4th Quarter	10/20/09	<0.2	<0.2	0.5	39	39.5	97
	10th Quarter	4/21/11	<0.2	<0.2	0.2	1.0	1.2	
PP-3A-I	Baseline	9/2/08	<0.2	1.6	19.4	0.8	21.8	50
	10th Quarter	4/20/11	<0.2	0.9	6.9	3.0	10.8	
PP-3B-I	Baseline	9/2/08	<0.2	2.0	1.2	<0.2	3.2	88
	9th Quarter	1/19/11	<0.2	<0.2	0.4	<0.2	0.4	
PP-4B-I	Baseline	9/3/08	<0.2	5.9	1,300	830	2,136	>99
	10th Quarter	4/18/11	<0.2	<0.2	0.3	0.3	0.6	
PP-4B-O	4th Quarter	10/21/09	<0.2	2	14	45	61	99
	10th Quarter	4/18/11	<0.2	<0.2	0.4	0.4	0.8	
PP-5B-I	Baseline	9/3/08	<0.2	0.4	4.9	<0.2	5.25	68
	Baseline	9/3/08	<0.2	0.4	4.8	<0.2		
	10th Quarter	4/20/11	<0.2	<0.2	1.7	<0.2	1.7	

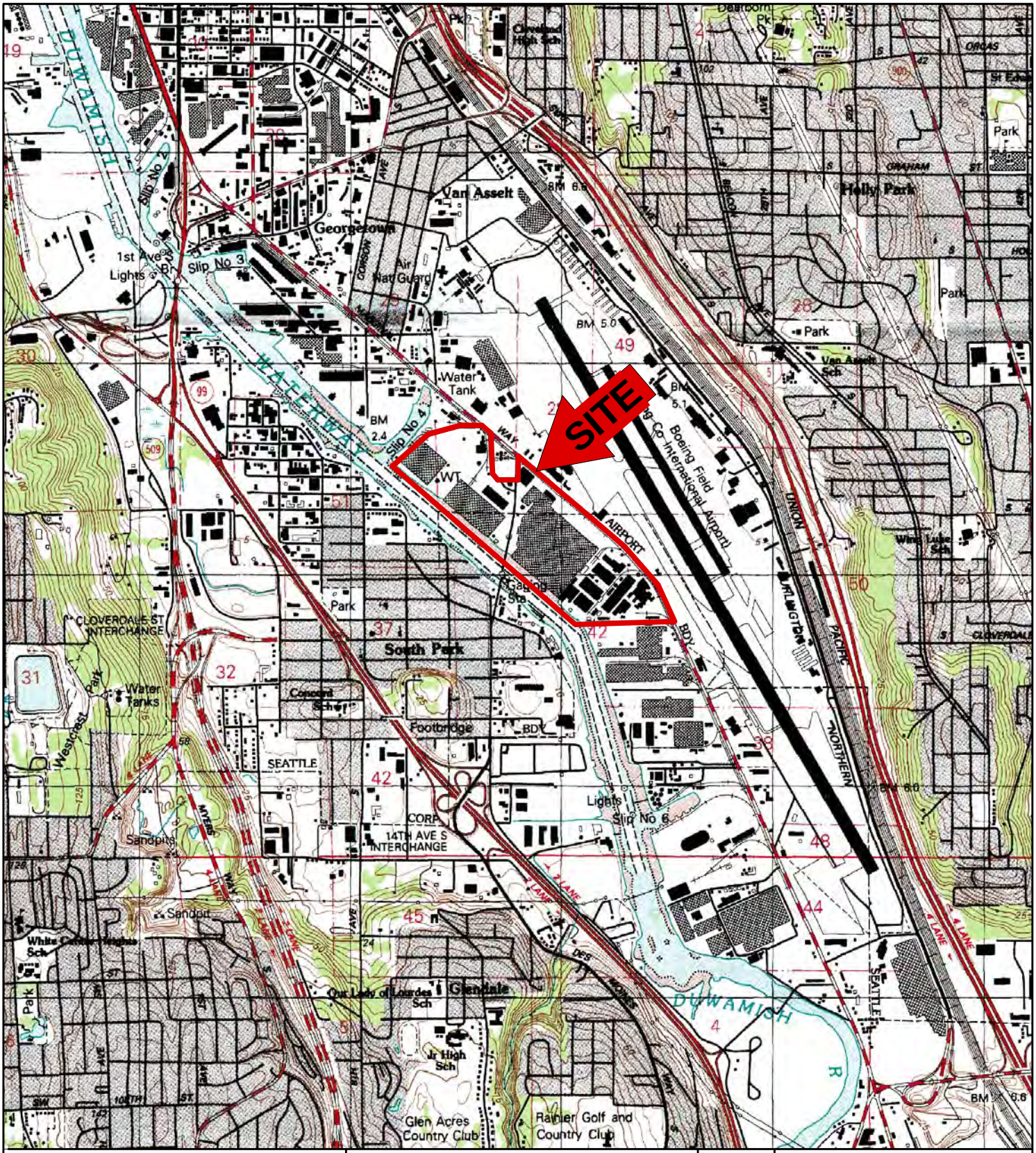
NOTES:

< = not detected at the value indicated

Averaged 8th and 9th quarter data were used for wells PL2-031A and PP-3B-I to remove suspected amomalous sampling results

Wells PL2-041AA, PL2-008C, PP-2B-O, and PP-4B-O used 4th Quarter data as baseline because these wells were added to the monitoring progam after the IM had started

FIGURES



KEY:

SOURCE: USGS 7.5 MINUTE QUANDRANGLE (TOPOGRAPHIC)

SEATTLE SOUTH
1983

SCALE = 1:25,000

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 1

BOEING PLANT 2
GENERAL LOCATION

PROJECT	2-66 ERD IM SEMIANNUAL REPORT
PREPARED FOR	THE BOEING COMPANY
LOCATION	BOEING PLANT 2 SEATTLE/TUKWILA, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	ARM	JLD	01/13/10

KEY:

2-66 SHEETPILE LOCATION

PLANT 2 BOUNDARY

0 100 200 400

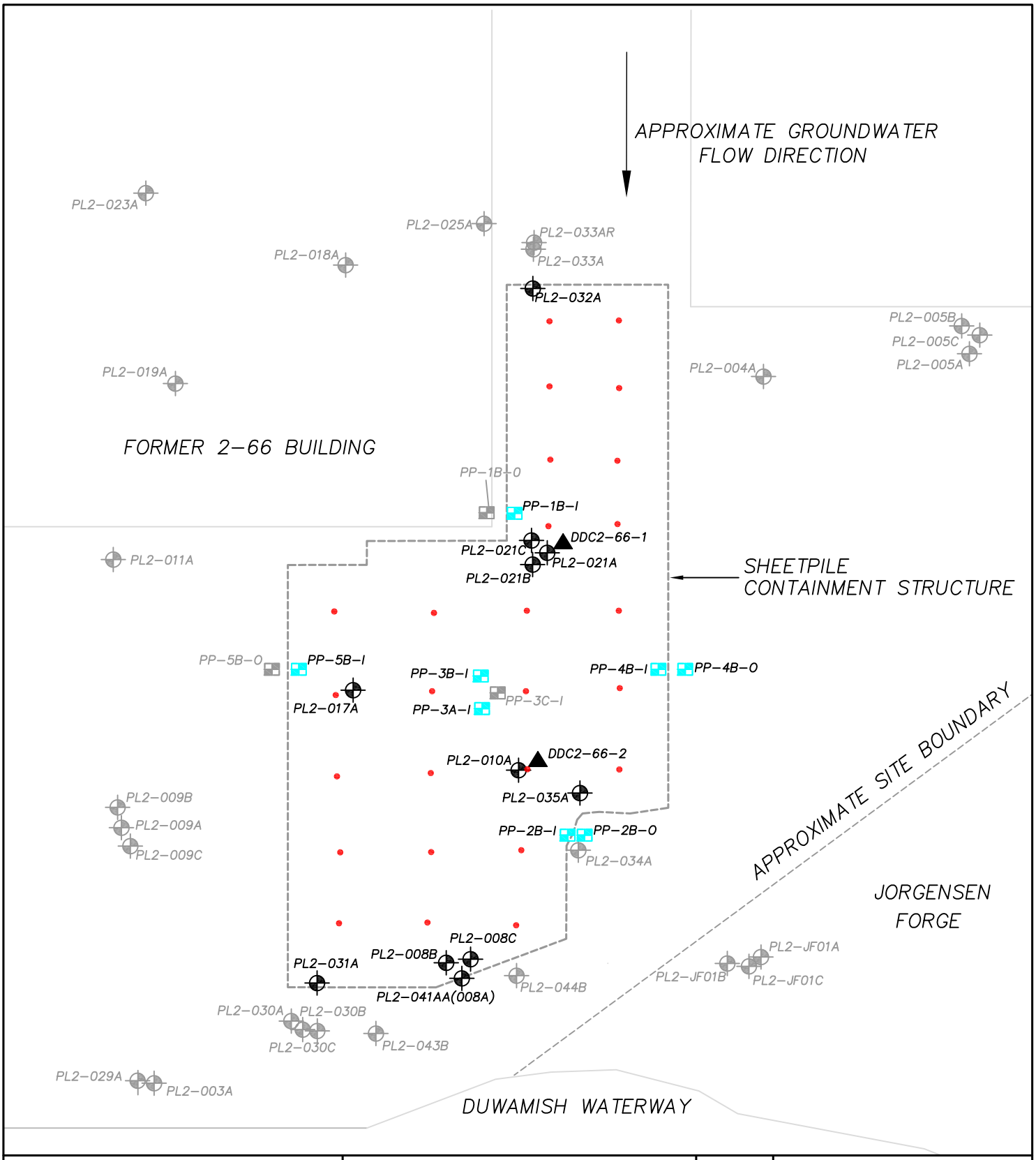
APPROXIMATE SCALE: 1" = 400'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 2

SITE REPRESENTATION

PROJECT	2-66 ERD IM SEMIANNUAL REPORT		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	BOEING PLANT 2 SEATTLE/TUKWILA, WASHINGTON		
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**
1 of 1	ARM	JLD	06/17/09



KEY:

- SUBSTRATE INJECTION LOCATION
- PERFORMANCE MONITORING WELLS
- OTHER MONITORING WELLS
- DDC WELL LOCATIONS
- PIEZOMETER/MONITORING WELL LOCATIONS
- SHEETPILE CONTAINMENT STRUCTURE

0 7.5' 15' 30'

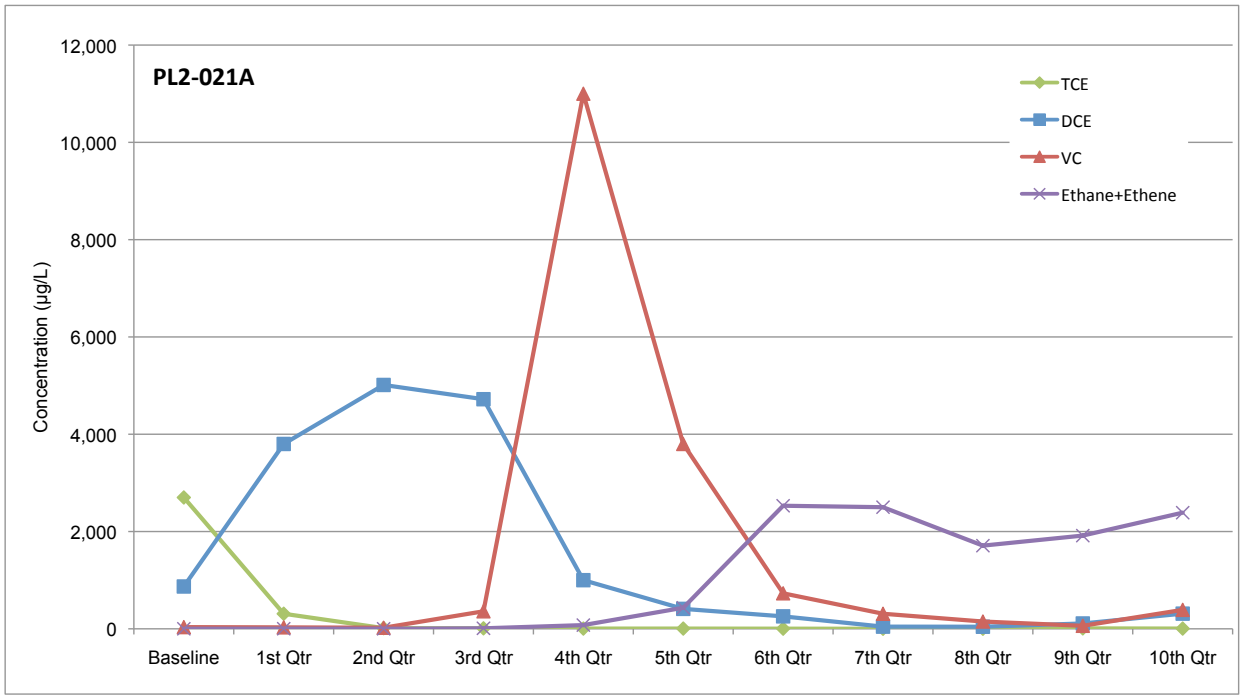
SCALE: 1" = 30'

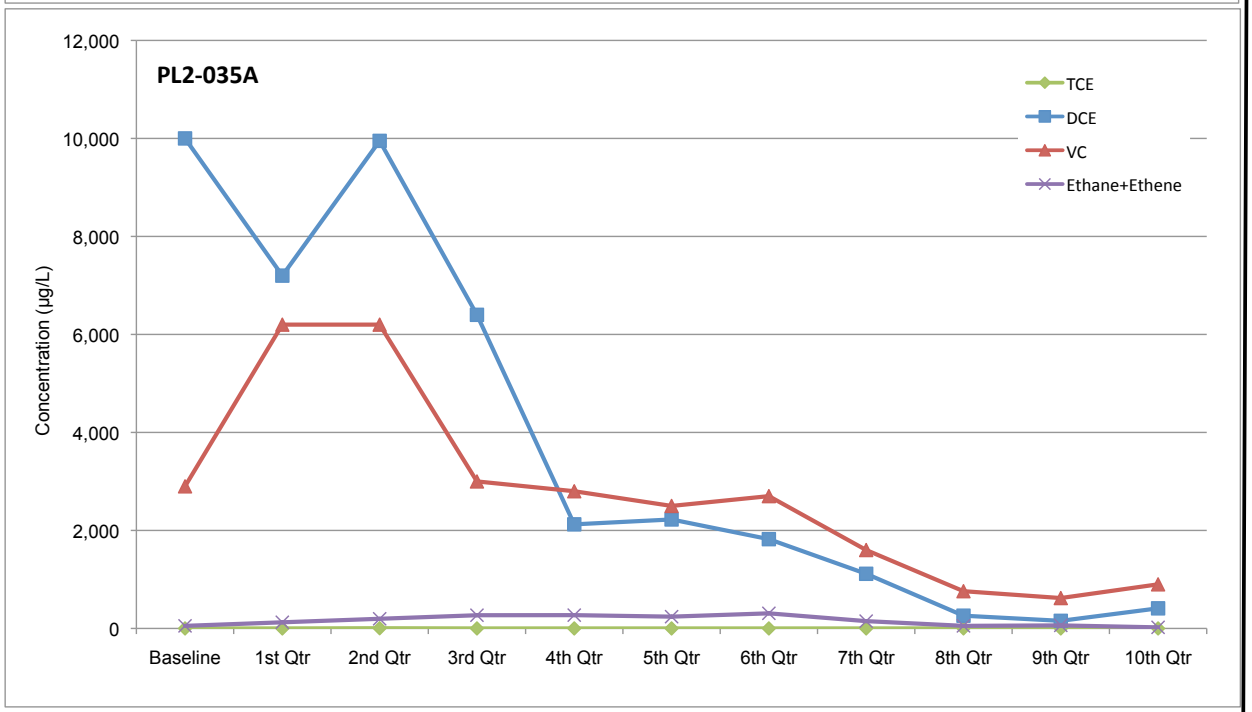
ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 3

PLAN VIEW OF
THE 2-66 ERD IM

PROJECT	2-66 ERD IM SEMIANNUAL REPORT		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	BOEING PLANT 2 SEATTLE / TUKWILA, WA		
SHEET 1 of 1	DRAWN BY ARM	REVIEWED BY JLD	DATE 12/03/09





KEY:

- Trichloroethene
- Dichlorothene
- Vinyl chloride
- Ethane + Ethene

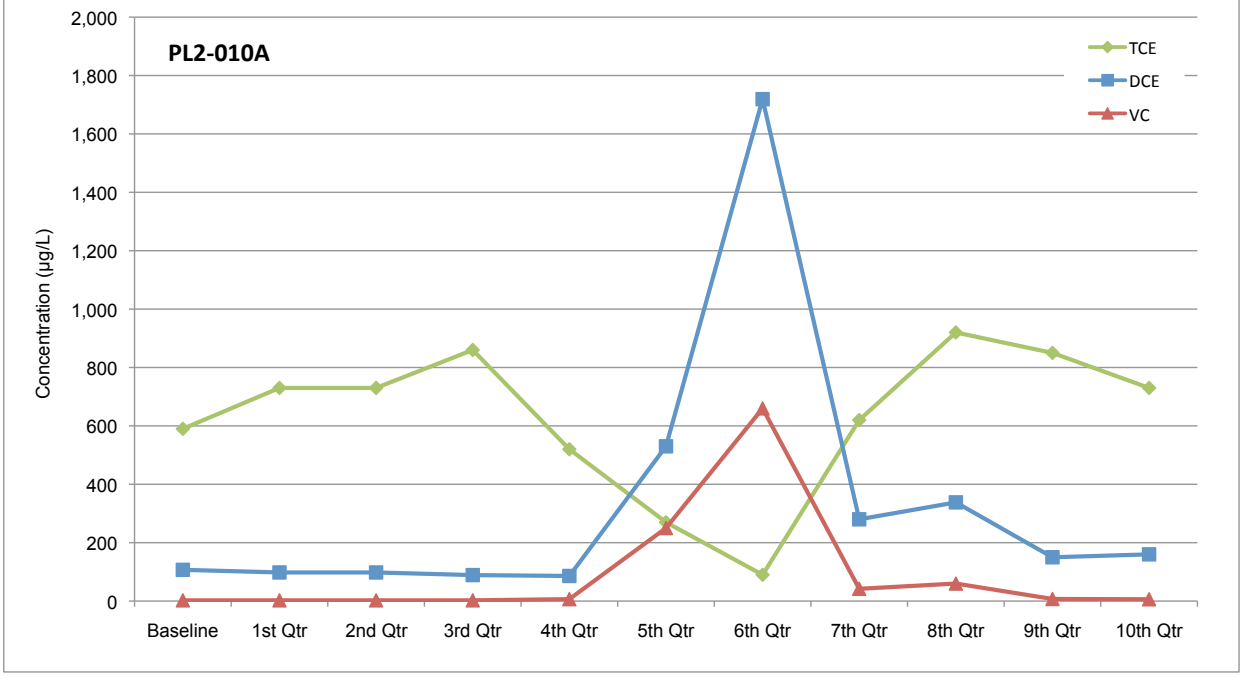
µg/L = micrograms per liter

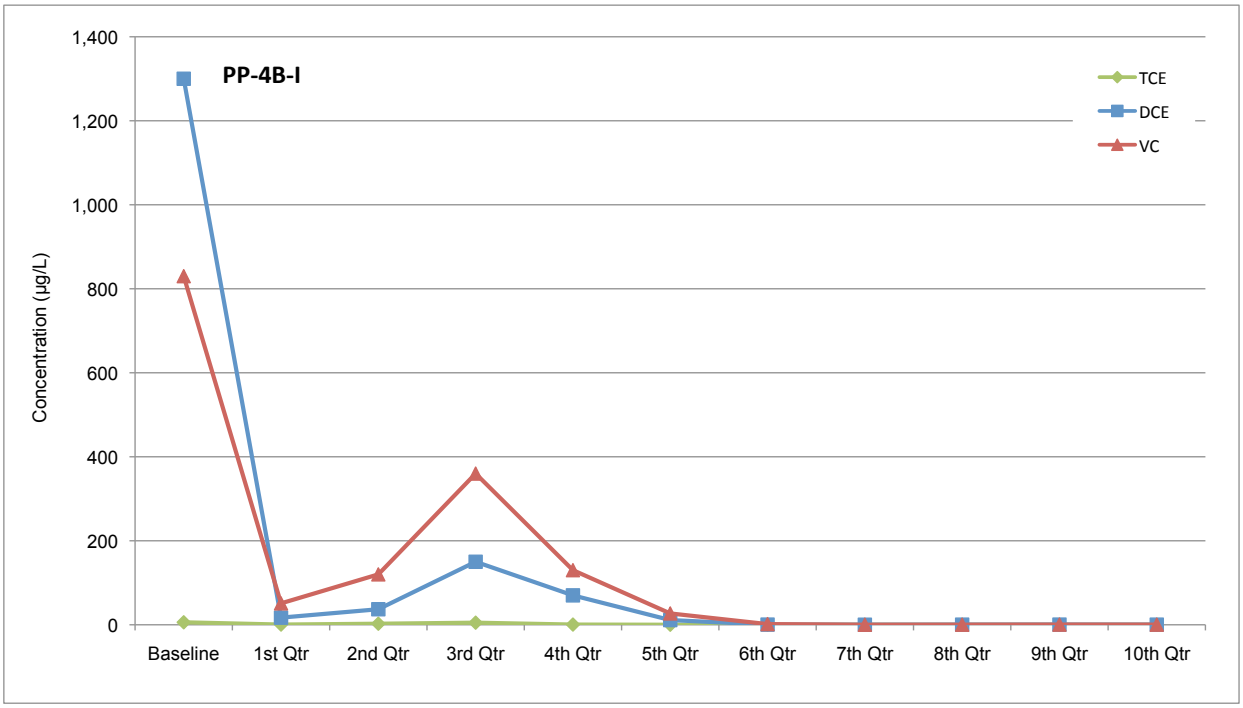
ENVIRONMENTAL PARTNERS INC

FIGURE 4

VOC TREND PLOTS FOR
PL2-021A AND PL2-035A

PROJECT	2-66 ERD IM SEMIANNUAL REPORT		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	BOEING PLANT 2 SEATTLE/TUKWILA, WA		
SHEET *1 of 1*	***DRAWN BY*** *JLD*	***REVIEWED BY*** *DCK*	***DATE*** *5/10/11*





KEY:

Trichloroethene

Dichlorothene

Vinyl chloride

µg/L = micrograms per liter

ENVIRONMENTAL PARTNERS INC

FIGURE 5

VOC TREND PLOTS FOR
PL2-010A AND PP-4B-I

PROJECT	2-66 ERD IM SEMIANNUAL REPORT		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	BOEING PLANT 2 SEATTLE/TUKWILA, WA		
SHEET *1 of 1*	***DRAWN BY*** *JLD*	***REVIEWED BY*** *DCK*	***DATE*** *5/10/11*

ATTACHMENT A

FIELD PARAMETER DATA

Table A1. Performance Monitoring - 9th Quarter Field Parameter Measurements (1/2011) 2-66 Sheetpile ERD IM							
Well ID	**pH**	**Dissolved Oxygen (mg/L)**	**ORP (mV)**	**Temp (°C)**	**Turbidity (NTU)**	**Specific Conductance (mS/cm)**	**Depth to Water (ft)**
PL2-041AA	8.17	0.56	-45.2	13.30	3.13	1.040	8.82
PL2-008B	7.06	0.58	-89.9	11.38	5.97	4.156	9.24
PL2-008C	8.32	0.40	-117.8	12.74	0.91	6.000	8.80
PL2-010A	6.20	0.78	-25.3	14.19	8.74	1.267	8.90
PL2-017A	6.51	6.03	-23.1	7.39	9.83	0.453	8.42
PL2-021A	6.59	0.49	-132.7	13.26	5.49	2.756	9.55
PL2-021B	6.66	0.61	-176.8	12.96	1.25	8.494	9.56
PL2-021C	7.96	0.52	-174.3	13.00	2.87	23.26	9.55
PL2-031A	7.97	0.55	-23.4	13.21	0.33	2.235	8.27
PL2-032A	6.51	0.73	-142.1	13.09	6.19	1.722	9.30
PL2-035A	6.44	0.46	-98.9	15.09	1.53	2.746	9.09
PP-1B-I	6.46	0.74	-160.9	11.70	5.49	12.66	9.73
PP-2B-I	6.96	0.52	-99.6	13.30	4.27	4.324	8.92
PP-2B-O	6.75	0.50	-96.0	13.79	1.21	3.399	8.82
PP-3A-I	6.87	0.65	-71.6	13.56	2.07	2.560	8.82
PP-3B-I	6.90	0.55	-207.4	13.09	5.44	12.20	8.77
PP-4B-I	6.76	0.53	-95.4	14.52	1.96	5.079	8.92
PP-4B-O	6.58	0.43	-118.2	14.01	2.87	5.090	8.75
PP-5B-I	7.05	0.60	-153.3	13.99	2.08	12.93	8.85

Notes:
ORP = oxidation-reduction potential, mv = millivolts
NTU = nephlometric turbidity units
mS/cm = milliSiemens per centimeter
mV = millivolts

Table A2. Performance Monitoring - 10th Quarter Field Parameter Measurements (4/2011) 2-66 Sheetpile ERD IM							
Well ID	**pH**	**Dissolved Oxygen (mg/L)**	**ORP (mV)**	**Temp (°C)**	**Turbidity (NTU)**	**Specific Conductance (mS/cm)**	**Depth to Water (ft)**
PL2-041AA	7.71	0.57	-33.0	12.36	1.63	0.927	9.88
PL2-008B	6.55	0.75	-41.3	13.70	6.51	3.741	10.52
PL2-008C	7.41	0.45	-106.2	13.64	0.87	5.960	11.67
PL2-010A	6.07	2.43	110.3	12.56	8.18	0.976	9.98
PL2-017A	6.18	4.53	106.0	9.34	5.84	0.870	9.80
PL2-021A	6.44	0.70	-78.4	11.60	9.73	2.164	10.46
PL2-021B	6.73	0.52	-81.6	13.00	4.08	7.373	10.68
PL2-021C	7.76	0.76	-180.7	13.88	8.87	23.07	10.48
PL2-031A	7.96	0.52	-19.0	11.62	4.89	0.601	9.44
PL2-032A	7.00	1.22	-56.0	12.02	7.82	2.366	10.35
PL2-035A	6.54	0.79	-18.9	13.68	3.69	2.568	10.39
PP-1B-I	6.59	0.71	-78.2	12.91	12.7	11.87	10.81
PP-2B-I	6.84	0.78	-59.6	13.81	9.29	4.896	12.07
PP-2B-O	7.03	1.03	17.4	14.54	8.62	3.336	13.86
PP-3A-I	7.05	1.09	-60.2	13.68	5.80	3.079	9.98
PP-3B-I	7.26	0.59	-66.9	13.88	9.13	11.19	10.24
PP-4B-I	6.77	0.59	-62.6	14.59	ND	4.222	11.57
PP-4B-O	6.76	0.58	-63.0	15.23	1.89	4.366	13.14
PP-5B-I	7.30	0.42	-70.1	13.20	5.41	17.41	10.12

Notes:
ORP = oxidation-reduction potential, mv = millivolts
NTU = nephlometric turbidity units
mS/cm = milliSiemens per centimeter
mV = millivolts
ND = no data

ATTACHMENT B

GROUNDWATER VOC ANALYTICAL DATA – ALL DETECTIONS

Table B1. 2-66 ERD Interim Measure Ninth Quarter – All VOC Detections

Groundwater - all results in µg/L

Constituent	Analytical Method	2011 TMCL	Laboratory Reporting Limit	PL2-041AA 1/18/11	PL2-008B 1/18/11	PL2-008C 1/18/11	PL2-010A 1/19/11	PL2-017A 1/17/11	PL2-021A 1/18/11	PL2-021A (dup) 1/18/11)	PL2-021B 1/18/11	PL2-021C 1/18/11	PL2-031A 1/18/11
Volatile Organic Compounds (VOCs)													
Vinyl chloride	EPA 8260C	2.4	0.2	1.0	1.8	<0.2	7.2	<0.2	64	62	3.7	0.6	<0.2
Chloroethane	EPA 8260C	NA	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	<1.0	<2.0	<0.2	<0.2	<0.2
Acetone	EPA 8260C	NA	5.0	<15	<5.0	<5.0	<100	<5.0	1,300	1,300	7.9	<5.0	<5.0
1,1-Dichloroethane	EPA 8260C	NA	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	9.3	9.3	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	EPA 8260C	NA	0.2	9.3	<0.2	<0.2	<4.0	<0.2	17	17	<0.2	0.3	<0.2
cis-1,2-Dichloroethene	EPA 8260C	130	0.2	120	2.1	<0.2	150	>0.2	90	93	2.5	<0.2	0.7
2-Butanone	EPA 8260C	NA	5.0	<15	<5.0	<5.0	<100	<5.0	530	560	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	EPA 8260C	NA	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	2.8	2.8	<0.2	<0.2	<0.2
Trichloroethene	EPA 8260C	0.51	0.2	56	2.3	<0.2	850	1.2	8.4	8.8	0.8	<0.2	0.4
Benzene	EPA 8260C	2.0	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	<1.0	<2.0	<0.2	<0.2	<0.2
Toluene	EPA 8260C	NA	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	<1.0	<2.0	<0.2	<0.2	<0.2
Chlorobenzene	EPA 8260C	NA	0.2	<0.6	<0.2	<0.2	<4.0	<0.2	<1.0	<2.0	<0.2	<0.2	<0.2

Constituent	Analytical Method	2011 TMCL	Laboratory Reporting Limit	PL2-032A 1/17/11	PL2-035A 1/19/11	PP-1B-I 1/18/11	PP-2B-I 1/19/11	PP-2B-I (dup) 1/19/11	PP-2B-O 1/19/11	PP-3A-I 1/19/11	PP-3B-I 1/19/11	PP-4B-I 1/19/11	PP-4B-O 1/19/11	PP-5B-I 1/17/11
Volatile Organic Compounds (VOCs)														
Vinyl chloride	EPA 8260C	2.4	0.2	1.1	620.0	0.3	0.4	0.4	1.8	0.4	<0.2	0.4	0.3	<0.2
Chloroethane	EPA 8260C	NA	0.2	<0.2	<4.0	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2
Acetone	EPA 8260C	NA	5.0	<5.0	<100	370	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	EPA 8260C	NA	0.2	1.2	4.8	0.5	0.3	0.2	1.8	0.6	<0.2	0.3	0.3	<0.2
trans-1,2-Dichloroethene	EPA 8260C	NA	0.2	<0.2	4.8	<0.2	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2	0.4
cis-1,2-Dichloroethene	EPA 8260C	130	0.2	0.6	150	<0.2	0.6	0.5	0.3	1.0	0.4	0.4	0.3	1.7
2-Butanone	EPA 8260C	NA	5.0	<5.0	<100	120	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	EPA 8260C	NA	0.2	<0.2	<4.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene	EPA 8260C	0.51	0.2	<0.2	<4.0	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2	<0.2	<0.2
Benzene	EPA 8260C	2.0	0.2	0.2	<4.0	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	EPA 8260C	NA	0.2	0.2	<4.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	EPA 8260C	NA	0.2	1.4	<4.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Notes:

< = not detected at the listed reporting limit

µg/L= micrograms per liter

NA = not applicable

Q = calibration out of control low

TMCL = Target Media Cleanup Level concentration

Table B2. 2-66 ERD Interim Measure Tenth Quarter – All VOC Detections

Groundwater - all results in µg/L

Constituent	Analytical Method	2011 TMCL	Laboratory Reporting Limit	PL2-041AA 4/18/2011	PL2-008B 4/18/2011	PL2-008C 4/18/2011	PL2-010A 4/21/2011	PL2-017A 4/19/2011	PL2-021A 4/19/2011	PL2-021B 4/19/2011	PL2-021C 4/20/2011	PL2-031A 4/20/2011	PL2-032A 4/20/2011	PL2-032A (dup) 4/20/2011
Volatile Organic Compounds (VOCs)														
Vinyl chloride	EPA 8260C	2.4	0.2	2.4	2.5	<0.2	6.2	<0.2	390	0.8	0.7	<0.2	1.0	0.9
Chloroethane	EPA 8260C	NA	0.2	<1.0	<0.2	<0.2	<4.0	<0.2	<2.0	<0.2	<0.2	<0.2	1.4	1.3
Acetone	EPA 8260C	NA	5.0	<25	<5.0	<5.0	<100	<5.0	770	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	EPA 8260C	NA	0.2	<1.0	<0.2	<0.2	<4.0	<0.2	11	<0.2	<0.2	<0.2	0.6	0.6
trans-1,2-Dichloroethene	EPA 8260C	NA	0.2	11	<0.2	<0.2	<4.0	<0.2	22	<0.2	0.3	<0.2	<0.2	<0.2
cis-1,2-Dichloroethene	EPA 8260C	130	0.2	110	3.2	<0.2	160	<0.2	290	0.6	<0.2	4.7	0.3	0.3
2-Butanone	EPA 8260C	NA	5.0	<25	<5.0	<5.0	<100	<5.0	290	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	EPA 8260C	NA	0.2	<1.0	<0.2	<0.2	<4.0	<0.2	3.0	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene	EPA 8260C	0.51	0.2	74	5.0	<0.2	730	1.5	5.0	0.2	<0.2	20	<0.2	<0.2
Benzene	EPA 8260C	2.0	0.2	<1.0	<0.2	<0.2	<4.0	<0.2	<2.0	<0.2	<0.2	<0.2	0.2	0.2
Chlorobenzene	EPA 8260C	NA	0.2	<1.0	<0.2	<0.2	<4.0	<0.2	<2.0	<0.2	<0.2	<0.2	1.4	1.3
o-Xylene	EPA 8260C	NA	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2

Constituent	Analytical Method	2011 TMCL	Laboratory Reporting Limit	PL2-035A 4/21/2011	PP-1B-I 4/19/2011	PP-2B-I 4/21/2011	PP-2B-I (dup) 4/21/2011	PP-2B-O 4/21/2011	PP-3A-I 4/20/2011	PP-3B-I 4/20/2011	PP-4B-I 4/18/2011	PP-4B-O 4/18/2011	PP-5B-I 4/20/2011
Volatile Organic Compounds (VOCs)													
Vinyl chloride	EPA 8260C	2.4	0.2	900	<0.2	0.5	0.4	1.0	3.0	2.5	0.3	0.4	<0.2
Chloroethane	EPA 8260C	NA	0.2	<10	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acetone	EPA 8260C	NA	5.0	<250	380	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	EPA 8260C	NA	0.2	<10	0.4	<0.2	<0.2	1.4	1.2	<0.2	0.3	0.3	<0.2
trans-1,2-Dichloroethene	EPA 8260C	NA	0.2	<10	<0.2	<0.2	<0.2	<0.2	1.9	<0.2	<0.2	<0.2	0.3
cis-1,2-Dichloroethene	EPA 8260C	130	0.2	410	<0.2	0.3	0.3	0.2	5.0	24	0.3	0.4	1.4
2-Butanone	EPA 8260C	NA	5.0	<250	96	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	EPA 8260C	NA	0.2	<10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene	EPA 8260C	0.51	0.2	<10	<0.2	0.2	<0.2	<0.2	0.9	0.3	<0.2	<0.2	<0.2
Benzene	EPA 8260C	2.0	0.2	<10	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	EPA 8260C	NA	0.2	<10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
o-Xylene	EPA 8260C	NA	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Notes:

< = not detected at the listed reporting limit

µg/L= micrograms per liter

NA = not applicable

Q = calibration out of control high for acetone

TMCL = Target Media Cleanup Level concentration

ATTACHMENT C

FIELD NOTES

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PLZ-032A	Date	1/12/11
Sample: ID	GW-110117-PLZ-032A-0	Field Team: (Initials)	JB + KA
Field Conditions	Cloudy + Windy		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.29'
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	1025
End Time	1107
Total Gallons Purged	2.6 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1031	.3	6.40	1.637 mS/cm	7.80	1.80 mg/L	12.58	-77.1	9.33	clear
1034	.4	6.44	1.634 mS/cm	8.09	1.67 mg/L	12.72	-99.3	9.33	clear
1037	.5	6.46	1.642 mS/cm	7.75	1.73 mg/L	12.89	-111.9	9.33	clear
1040	.6	6.48	1.665 mS/cm	6.40	1.62 mg/L	12.89	-124.0	9.33	clear
1043	.8	6.49	1.680 mS/cm	7.39	1.64 mg/L	12.87	-130.9	9.33	clear
1046	1.0	6.49	1.687 mS/cm	6.81	1.46 mg/L	12.92	-134.1	9.33	clear
1049	1.2	6.50	1.700 mS/cm	12.2	1.25 mg/L	12.99	-136.8	9.33	clear
1052	1.4	6.51	1.712 mS/cm	8.11	1.09 mg/L	13.06	-139.3	9.32	clear
1055	1.6	6.51	1.715 mS/cm	7.21	0.79 mg/L	13.03	-140.5	9.32	clear
1058	1.8	6.51	1.722 mS/cm	6.19	0.93 mg/L	13.09	-142.1	9.32	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1100	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1100	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	1100	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	1100	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	1100	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	1100	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1100	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1107

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-SB-I	Date	1/17/11
Sample: ID	GW-110117-PP-SB-I-0	Field Team: (Initials)	SB + LA
Field Conditions	Cloudy + Windy		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	8.82
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: _____

Start Time	1113
End Time	
Total Gallons Purged	

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1130	.75	7.32	0.136 mS/cm	2.10	1.98 mg/L	14.03	-63.6	8.87	clear
1133	.90	7.31	0.162 mS/cm	1.93	1.38 mg/L	14.03	-63.9	8.91	clear
1136	1.1	7.28	0.176 mS/cm	2.91	0.94 mg/L	14.07	-62.7	8.92	clear
1139	1.3	7.27	0.194 mS/cm	1.80	0.77 mg/L	14.08	-61.5	8.94	clear
1142	1.5	7.25	0.208 mS/	1.88	0.69 mg/L	14.08	-63.8	8.96	clear
1145	1.7	7.24	0.221 mS/	1.77	0.65 mg/L	14.08	-93.0	8.96	clear
1148	1.9	7.24	0.230 mS/	2.62	0.63 mg/L	14.09	-110.8	8.96	clear
1151	2.1	7.24	0.248 mS/	2.20	0.62 mg/L	14.05	-118.9	8.97	clear
1154	2.3	7.21	0.252 mS/	2.24	0.61 mg/L	14.02	-123.1	8.97	clear
1157	2.5	7.09	0.472 mS/	2.19	0.63 mg/L	14.02	-120.3	8.97	clear
1211	4.7	6.96	12.69 mS/	1.88	0.62 mg/L	14.01	-140.4	9.02	clear
1214	4.9	7.01	12.83 mS/	1.97	0.62 mg/L	13.97	-146.0	9.02	clear
1217	5.1	7.02	12.89 mS/	2.05	0.62 mg/L	13.98	-150.6	9.03	clear
1220	5.3	7.05	12.93 mS/	2.08	0.60 mg/L	13.99	-153.3	9.04	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1222	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1222	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C HCl	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1222	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-017A	Date	1/17/11
Sample: ID	GW-110117-PL2-017A-0	Field Team: (Initials)	KA JB
Field Conditions	Partly Sunny ~55°F, Windy		

Purge Information

Well Diameter (in.)	4"
Well Depth (ft.)	20.8
Initial Depth to Water (ft.)	
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1230
End Time	
Total Gallons Purged	

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1230	—							8.32	
1235	0.3	7.42	0.666	10.45	5.89	8.07	-95.0	8.45	Clear
1242	0.9	6.91	0.475	10.30	5.85	7.72	-66.5	8.47	Clear
1245	1.2	6.79	0.468	9.88	5.81	7.71	-58.1	8.48	Clear
1248	1.5	6.73	0.466	10.23	5.82	7.69	-53.2	8.48	Clear
* 1251	1.8	6.69	0.464	10.35	5.93	7.65	-48.6	8.48	Clear
1304	2.7	6.54	0.457	10.06	5.98	7.43	-31.2	8.45	Clear
1310	3.3	6.53	0.454	10.27	6.02 | 5.96*	7.37	-27.8	8.43	Clear
1313	3.6	6.52	0.453	9.95	6.04 | 5.93*	7.37	-24.9	8.42	Clear
1316	3.9	6.51	0.453	9.83	6.03 | 5.99*	7.39	-23.1	8.41	Clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1319	(3) 40-mL VOA	HCl, cool to 4°C	MS/MSD
TOC (415.1)	1319	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	MS/MSD
Dissolved gasses (MEE) (RSK-175)	1319	(3) 40-mL VOA	cool to 4°C HCl	MS/MSD
Ferrous Iron (SM3500 Fe B-97)	1319	250 mL amber	cool to 4°C Do NOT filter	MS/MSD
Anions (EPA 300.0)	1319	(1) 500 mL HDPE	cool to 4°C	MS/MSD
Organics Acids (VFA)	1319	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	MS/MSD
Metals (200.8&6010B)	1319	(1) 500 mL HDPE	field filter, HNO_3	MS/MSD
Census	1319	bio-flo&MI falcon tube	cool to 4°C	NO MS/MSD

End Time

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

* DO reading not consistent with previous Qtrly parameters, Calibrate other YSI to double check DO reading

#2 YSI 556 MPS
SN 08B100976

ph paper = 6

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-1B-I	Date	1/18/11
Sample: ID	GW-110118-PP-1B-I-0	Field Team: (Initials)	JB & KA
Field Conditions	Cloudy & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.73
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: : _____

Start Time	0800
End Time	0839
Total Gallons Purged	1.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0814	.5	6.36	12.66 mS/cm	11.2	1.60 mg/L	11.36	-129.4	9.81	clear
0817	.65	6.39	12.82 mS/cm	7.84	1.34 mg/L	11.46	-143.9	9.84	clear
0820	.80	6.40	12.85 mS/cm	6.32	1.10 mg/L	11.52	-149.2	9.87	clear
0823	.90	6.42	12.83 mS/cm	6.03	0.96 mg/L	11.55	-154.5	9.89	clear
0826	1.0	6.44	12.78 mS/cm	6.11	0.88 mg/L	11.61	-156.1	9.9	clear
0829	1.15	6.45	12.72 mS/cm	5.69	0.80 mg/L	11.65	-152.4	9.93	clear
0832	1.30	6.46	12.66 mS/cm	5.49	0.74 mg/L	11.70	-160.9	9.95	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0834	(3) 40-mL VOA	~~HCl~~, cool to 4°C	
TOC (415.1)	0834	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0834	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0839

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-021A	Date	7/18/11
Sample: ID	GW-110718-PL2-021A-0,1	Field Team: (Initials)	KA JB
Field Conditions	Cloudy		

Purge Information

Well Diameter (in.)	4"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.66
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	0841
End Time	1000
Total Gallons Purged	2 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0936	0.8	6.66	2.766	4.89	0.56	13.44	-125.8	10.15	clear
0939	1.0	6.63	2.764	5.17	0.55	13.41	-127.3	10.19	clear
0942	1.25	6.61	2.760	4.95	0.52	13.32	-130.7	10.20	clear
0945	1.4	6.60	2.759	5.16	0.51	13.27	-130.6	10.20	clear
~~0948~~	1.55	6.59	2.756	5.49	0.49	13.26	-132.7	10.23	clear
↑ Time is 40 minutes fast									

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0915	(3) 40-mL VOA	HCl, cool to 4°C	0920
TOC (415.1)	0915	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	0920
Dissolved gasses (MEE) (RSK-175)	0915	(3) 40-mL VOA	cool to 4°C	0920
Ferrous Iron (SM3500 Fe B-97)	0915	250 mL amber	cool to 4°C Do NOT filter	0920
Anions (EPA 300.0)	0915	(1) 500 mL HDPE	cool to 4°C	0920
Organics Acids (VFA)	0915	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	0920
Metals (200.8&6010B)	0915	(1) 500 mL HDPE	field filter, HNO_3	0920
Census	0915	bio-flo&MI falcon tube	cool to 4°C	0920 500mL

End Time 1000

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

purge rate = 0.2 gal/min

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PLZ-021C	Date	1/18/11
Sample: ID	GW-110118-PLZ-021C-0	Field Team: (Initials)	JB + CA
Field Conditions	Cloudy & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.76'
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
(Peristaltic Pump)
Other: :

Start Time	1045
End Time	1115
Total Gallons Purged	1.3 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1057	.5	7.80	23.18	10.43	0.79 mg/L	13.24	-151.4	10.89	clear
1100	.65	7.85	23.22	7.05	0.69 mg/L	13.25	-164.1	10.88	clear
1103	.80	7.90	23.25	5.71	0.62 mg/L	13.07	-170.8	10.88	clear
1106	.95	7.93	23.30	3.80	0.57 mg/L	13.03	-173.1	10.85	clear
1109	1.10	7.96	23.26	2.87	0.52 mg/L	13.00	-174.3	10.81	clear

Sample Information

Sample Method(s) : (Peristaltic pump) / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1111	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1111	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1111	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1115

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PLZ-021B	Date	11/18/11
Sample: ID	GW-111118-PLZ-021B-0	Field Team: (Initials)	TB + KA
Field Conditions	Cloudy & COOL		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.74
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1008
End Time	1042
Total Gallons Purged	1.9 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1019	.5	6.54	8.595	2.78	1.30 mg/L	12.88	-149.5	9.76	clear
1022	.7	6.58	8.525	1.38	0.99 mg/L	12.97	-159.0	9.77	clear
1025	.9	6.61	8.495	2.27	0.83 mg/L	13.00	-166.3	9.78	clear
1028	1.1	6.64	8.480	2.83	0.73 mg/L	12.99	-170.7	9.79	clear
1031	1.3	6.66	8.489	1.14	0.66 mg/L	12.95	-169.2	9.78	clear
1034	1.5	6.66	8.494	1.25	0.61 mg/L	12.96	-176.8	9.77	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1037	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1037	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1037	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1042

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-031A	Date	1/18/11
Sample: ID	GW-110118-PL2-031A-0,1	Field Team: (Initials)	JB + KA
Field Conditions	Cloudy & Cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	8.44
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: : _____

Start Time	1122
End Time	1203
Total Gallons Purged	2.0

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1135	.6	8.37	2.147	3.02	0.48	13.18	-9.5	8.43	clear
1138	.8	8.20	2.157	2.49	0.50	13.13	-14.4	8.43	clear
1141	1.0	8.19	2.200	3.01	0.51	13.17	-16.6	8.43	clear
1144	1.2	8.11	2.225	3.48	0.53	13.21	-18.2	8.43	clear
1147	1.4	8.06	2.239	4.31	0.53	13.21	-19.1	8.41	clear
1150	1.6	8.01	2.236	2.56	0.55	13.20	-19.9	8.41	clear
1153	1.8	7.97	2.235	0.33	0.55	13.21	-23.4	8.40	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1155	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1155	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	1155	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	1155	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	1155	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	1155	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1155	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1203

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, pararneters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-41AA	Date	11/18/11
Sample: ID	GW-111018-PL2-041AA-0	Field Team: (Initials)	KA JR
Field Conditions	Raining ~45°F		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	8.90
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1206
End Time	1303
Total Gallons Purged	3.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1229	1.5	8.80	0.809	3.20	0.52	13.31	-40.2	9.01	clear light green
1232	1.75	8.67	0.854	2.95	0.52	13.24	-41.8	9.01	clear lt. brown
1235	1.9	8.61	0.884	2.88	0.52	13.21	-41.9	9.01	clear light brown
1238	2.1	8.49	0.934	2.88	0.53	13.17	-43.6	9.01	clear light brown
1241	2.3	8.42	0.988	2.70	0.55	13.26	-43.8	9.01	clear light brown
1244	2.5	8.32	1.004	2.74	0.55	13.24	-44.5	9.01	clear light br.
1247	2.6	8.29	1.014	2.73	0.55	13.28	-44.6	9.00	clear light br.
1250	2.8	8.22	1.029	3.19	0.56	13.28	-44.7	9.00	clear light br.
1253	3.0	8.17	1.040	3.13	0.56	13.30	-45.2	9.00	clear light br.

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1255	(3) 40-mL VOA	~~HCl~~, cool to 4°C	
TOC (415.1)	—	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1255	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1303

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

pH paper = 8

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-008C	Date	11/8/11
Sample: ID	GW-110118-PL2-008C-0	Field Team: (Initials)	SB & KA
Field Conditions	Cloudy & Rainy		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	8.96
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1307
End Time	1337
Total Gallons Purged	1.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1315	.40	8.12	5.990	3.34	0.44	12.64	-92.6	8.46	clear
1318	.55	8.20	5.987	2.18	0.43	12.74	-72.4	8.44	clear
1321	.70	8.25	5.980	1.00	0.42	12.79	-96.7	8.43	clear
1324	.85	8.29	5.990	1.01	0.41	12.79	-107.5	8.42	clear
1327	1.0	8.30	5.997	0.96	0.40	12.75	-113.8	8.44	clear
1330	1.15	8.32	6.000	0.91	0.40	12.74	-117.8	8.45	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1333	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1333	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1337

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-008B	Date	1/18/11
Sample: ID	GW-110118-PL2-008B-0	Field Team: (Initials)	JB KM
Field Conditions	Raining		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.20
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1339
End Time	1406
Total Gallons Purged	1.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1342	0.5	7.45	4,051	10.72	0.53	11.38	-64.2	9.30	clear
1345	0.65	7.33	4,055	9.61	0.54	11.30	-69.7	9.32	clear
1348	0.80	7.23	4,071	8.36	0.55	11.25	-71.0	9.33	clear
1351	0.95	7.15	4,134	6.52	0.56	11.29	-86.7	9.35	clear
1354	1.10	7.10	4,149	5.58	0.58	11.35	-85.2	9.36	clear
1357	1.25	7.06	4,156	5.97	0.58	11.38	-89.9	9.37	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1400	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1400	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1400	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1406

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-3A-I	Date	11/9/11
Sample: ID	GW-111109-PP-3A-I-0	Field Team: (Initials)	JR/KA
Field Conditions	cool + cloudy		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.03
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	0755
End Time	0835
Total Gallons Purged	1.9 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0807	.60	6.45	2.560 mS/cm C	5.58	1.02 mg/L	13.41	14.0	9.04	clear
0810	.75	6.58	2.582 mS/cm C	4.47	0.95 mg/L	13.44	-3.9	9.04	clear
0813	.90	6.67	2.595 mS/cm C	3.58	0.97 %	13.50	-19.8	9.04	clear
0816	1.05	6.75	2.595 mS/cm C	2.59	0.76 mg/L	13.53	-38.8	9.05	clear
0819	1.20	6.77	2.590 mS/cm C	2.01	0.82 %	13.55	-52.1	9.06	clear
0822	1.35	6.84	2.578 mS/cm C	1.86	6.72 mg/L	13.50	-57.6	9.06	clear
0825	1.50	6.84	2.569 mS/cm C	2.85	0.71 %	13.50	-67.8	9.06	clear
0828	1.65	6.87	2.560 mS/cm C	2.07	6.65 %	13.56	-71.6	9.06	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0830	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0830	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0830	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0835

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-3B-I	Date	1/19/11
Sample: ID	GW-110119-PP-3B-I-0	Field Team: (Initials)	JB & KA
Field Conditions	clear & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	3.98
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
(Peristaltic Pump)
Other: :

Start Time	0837
End Time	0908
Total Gallons Purged	1.3 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0846	.4	6.77	11.92 mS/cm	1.80	0.56 mg/L	12.99	-193.9	9.12	clear
0849	.55	6.84	11.99 mS/cm	3.33	0.55 mg/L	12.92	-205.5	9.13	clear
0852	.70	6.87	12.08 mS/cm	6.73	0.56 mg/L	12.95	-213.3	9.13	clear
0855	.85	6.90	12.12 mS/cm	2.41	0.56 mg/L	13.05	-217.5	9.15	clear
0858	1.0	6.90	12.16 mS/cm	2.93	0.56 mg/L	13.03	-218.6	9.16	clear
0901	1.15	6.90	12.20 mS/cm	5.44	0.55 mg/L	13.09	-207.4	9.17	clear

Sample Information

Sample Method(s) : (Peristaltic pump) / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0904	(3) 40-mL VOA	~~HCl~~, cool to 4°C	NON-PRESERVED
TOC (415.1)	0904	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0904	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0908

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-01OA	Date	11/9/11
Sample: ID	(2W)-110119-PL2-01OA-0	Field Team: (Initials)	JP MA
Field Conditions	Clear + cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.16
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: : _____

Start Time	0909
End Time	0945
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0914	0.35	6.71	1.484	10.13	0.68	14.48	-56.0	9.59	clear
0917	0.5	6.55	1.407	9.34	0.76	14.49	-49.3	9.64	clear
0920	0.6	6.43	1.359	11.1	0.87	14.34	-43.5	9.66	clear
0923	0.8	6.38	1.325	11.7	0.91	14.36	-39.1	9.68	clear
0926	1.0	6.27	1.296	10.28	0.87	14.33	-33.8	9.68	clear
0929	1.2	6.25	1.279	9.85	0.83	14.28	-30.0	9.68	clear
0932	1.4	6.18	1.273	8.99	0.81	14.22	-27.4	9.68	clear
0935	1.6	6.20	1.267	8.74	0.78	14.19	-25.3	9.68	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0937	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0937	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0937	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 0945

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-035A	Date	1/19/11
Sample: ID	GW-110119-PL2-035A-0	Field Team: (Initials)	KA JB
Field Conditions	Sunny ~40°F		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.40
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	0951
End Time	1031
Total Gallons Purged	2.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1002	.7	6.32	2.736 mS/cm	2.97	1.07 mg/L	15.08°C	-21.0	9.48	clear
1005	.9	6.36	2.741 mS/cm	2.24	0.85 mg/L	15.08°C	-43.8	9.49	clear
1008	1.1	6.37	2.739 mS/cm	2.41	0.69 mg/L	15.15°C	-62.9	9.50	clear
1011	1.3	6.40	2.738 mS/cm	3.06	0.60 mg/L	15.24°C	-76.4	9.51	clear
1014	1.5	6.40	2.745 mS/cm	2.17	0.54 mg/L	15.18°C	-86.5	9.52	clear
1017	1.7	6.43	2.738 mS/cm	5.64	0.50 mg/L	15.16°C	-92.9	9.53	clear
1020	1.9	6.44	2.746 mS/cm	1.53	0.46 mg/L	15.09°C	-98.9	9.54	clear

Sample Information

Sample Method(s): **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1022	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1022	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	1022	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	1022	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1022	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time: 1031

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-2B-0	Date	11/9/11
Sample: ID	GW-110119-PP-2B-0-0	Field Team: (Initials)	JB + KA
Field Conditions	clear + cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.90
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1032
End Time	1100
Total Gallons Purged	1.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1044	.5	6.72	3.387 mS/cm	1.80	0.46 mg/L	13.55	-78.6	10.01	clear
1047	.7	6.73	3.387 mS/cm	2.64	0.48 mg/L	13.86	-86.3	10.03	clear
1050	.9	6.76	3.397 mS/cm	1.72	0.49 mg/L	13.85	-91.1	10.05	clear
1053	1.1	6.75	3.399 mS/cm	1.21	0.50 mg/L	13.79	-96.0	10.07	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1055	(3) 40-mL VOA	~~HCl~~, cool to 4°C	
TOC (415.1)	—	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1055	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1100

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-28-I	Date	1/19/11
Sample: ID	GW-110119-PP-28-I-0,1	Field Team: (Initials)	JB + KA
Field Conditions	Clear + cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.74'
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1101
End Time	1135
Total Gallons Purged	1.5 Gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1105	0.3	7.04	4.301	8.16	0.56	13.42	-77.7	10.01	clear
1108	0.5	7.06	4.310	7.15	0.55	13.37	-86.3	10.01	clear
1111	0.7	7.03	4.321	5.65	0.50	13.34	-95.6	10.01	clear
1114	0.9	7.00	4.324	4.90	0.51	13.31	-97.1	10.01	clear
1117	1.1	6.96	4.324	4.27	0.52	13.30	-99.6	10.01	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1119	(3) 40-mL VOA	~~HCl~~, cool to 4°C	1124 Duplicate
TOC (415.1)	1119	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	1124 Duplicate
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1119	(1) 500 mL HDPE	field filter, HNO_3	1124 Duplicate
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1135

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-4B-I	Date	1/19/11
Sample: ID	GW-110119-PP-4B-I-O	Field Team: (Initials)	LB + KA
Field Conditions	Clear & Cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.63
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	1140
End Time	1215
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1149	.3	6.91	4,197 mS/cm	1.36	0.49 mg/L	14.65	-85.0	9.81	clear
1152	.5	6.85	4,555 mS/cm	3.26	0.46 mg/L	14.39	-89.2	9.83	clear
1155	.7	6.79	4,825 mS/cm	7.13	0.49 mg/L	14.42	-93.0	9.84	clear
1158	.9	6.76	5,059 mS/cm	3.21	0.51 mg/L	14.50	-95.0	9.85	clear
1201	1.1	6.76	5,097 mS/cm	0.99	0.52 mg/L	14.49	-95.6	9.86	clear
1204	1.3	6.77	5,087 mS/cm	1.57	0.54 mg/L	14.50	-95.2	9.87	clear
1207	1.5	6.76	5,079 mS/cm	1.96	0.53 mg/L	14.52	-95.4	9.88	clear

Sample Information

Sample Method(s) **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1211	(3) 40-mL VOA	~~HCl~~, cool to 4°C	
TOC (415.1)	1211	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1211	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1215

Comments / Exceptions:

Presence of floating product? YES (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-4B-0	Date	1/19/11
Sample: ID	GW-110119-PP-4B-0-0	Field Team: (Initials)	JB & KA
Field Conditions	Clear & Cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.62
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1216
End Time	1300
Total Gallons Purged	2.0

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1222	0.4	6.62	3.929	1.71	1.28	14.88	-109.7	9.71	clear
1225	0.5	6.57	4.019	1.84	1.14	14.77	-115.3	9.65	clear
1228	0.7	6.52	4.160	2.18	0.97	14.80	-119.5	9.65	clear
1231	0.8	6.49	4.547	1.63	0.82	14.73	-122.7	9.63	clear
1234	1.0	6.50	5.003	1.62	0.73	14.64	-121.9	9.60	clear
1237	1.2	6.54	5.164	1.19	0.65	14.54	-119.7	9.58	clear
1240	1.3	6.54	5.176	1.12	0.58	14.45	-119.0	9.56	clear
1243	1.5	6.56	5.160	1.18	0.53	14.28	-118.5	9.54	clear
1246	1.6	6.57	5.112	1.24	0.48	14.11	-118.9	9.52	clear
1249	1.8	6.58	5.116	1.31	0.45	14.08	-118.5	9.50	clear
1252	1.9	6.58	5.090	2.87	0.43	14.01	-118.2	9.48	clear

* Pump stopped temporarily

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1254	(3) 40-mL VOA	~~HCl~~, cool to 4°C	
TOC (415.1)	—	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	—	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	—	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	—	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	—	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1254	(1) 500 mL HDPE	field filter, HNO_3	
Census	—	bio-flo&MI falcon tube	cool to 4°C	

End Time 1300

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station		Date	
Sample: ID		Field Team: (Initials)	
Field Conditions			

Purge Information

Well Diameter (in.)	
Well Depth (ft.)	
Initial Depth to Water (ft.)	
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: : _____

Start Time	
End Time	
Total Gallons Purged	

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)		(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)		(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

Boeing Plant 2, 2-66 Sheetpile IM injection Baseline
Monitoring Well Network Water Levels

Well	Date & Time	Depth to Water (ft.)	Measuring Point Elevation (ft. NAVD)	Water Level Elevation (ft. NAVD)	Measured Total Depth (ft. bgs)	Comments
PL2-010A	0933 1/17/11	8.90	12.09		20.61	
PL2-017A	0922 1/17/11	8.42	11.81		20.61	
PL2-021A	0953 1/17/11	9.55	12.72		19.75	
PL2-021B	0950 1/17/11	9.56	12.67		48.46	
PL2-021C	0956 1/17/11	9.55	12.56		91.52	
PL2-031A	0924 1/17/11	8.27	11.45		29.06	
PL2-032A	0915 1/17/11	9.30	12.47		29.24	
PL2-035A	0949 1/17/11	9.09	12.26		29.68	
PL2-008B	0930 1/17/11	9.24				
PL2-008C	0928 1/17/11	8.80				
PP-1B-I	0948 1/17/11	9.73	12.83		50	
PP-2B-I	0946 1/17/11	8.92	12.31		49.89	
PP-2B-O	0944 1/17/11	8.82				
PP-3A-I	0937 1/17/11	8.82	12.02		20.2	
PP-3B-I	0935 1/17/11	8.77	11.88		47.62	
PP-4B-I	0942 1/17/11	8.92	12.29		50.05	
PP-4B-O	0940 1/17/11	8.75				
PP-5B-I	0918 1/17/11	8.85	12.09		50.02	
PL2-041A	A 0926 1/17/11	8.82				

15 wells
2 Dupes
1 MS/MSD

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: SE88	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: **Boeing**	Phone:	Date: 1/17/11	Ice Present? Y
Client Contact: **Will Ernst**		No. of Coolers: 2	Cooler Temps: 1.9, 3.9
Client Project Name: **2-66 ERD IM Performance Sampling**			
Client Project #: 17513	Samplers: J. Bernthal, K. Addis		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	Number of Containers	VOCs EPA 8260C	TOC EPA 415.1	MEE RSK-175	Ferrous Iron 3500-FED	Metals (dissolved)** As & Mn only	Anions EPA 300.0 (NO_3 & SO_4)	VFA organic acids (by MI)	qDHC bacterial census (by MI)	Notes/Comments
					Analysis Requested								** dissolved metals are field filtered
GW-110117-PL2-032A-0	1/17/11	1100	GW	12	X	X	X	X	X	X	X		⊗ = No MS/MSD
GW-110117-PP-5B-I-0	↓	1222	↓	5	X	X			X				1 Liter filtered
GW-110117-PL2-017A-0	↓	1319	↓	37	X	X	X	X	X	X	X	⊗	MS/MSD
Trip Blank	↓	—	—	2	X								

Comments/Special Instructions: More samples to follow

	Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)				
Printed Name:	Josh Bernthal	Jennifer Millsap		
Company:	EPI	ARI		
Date & Time:	1505 1/17/11	1/17/11 1505		

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: SF09	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: **Boeing**	Phone:	Date: 1/18/11	Ice Present? Y
Client Contact: **Will Ernst**		No. of Coolers: 2	Cooler Temps: 6.0, 5.8
Client Project Name: **2-66 ERD IM Performance Sampling**			
Client Project #: 17513	Samplers: J. Bernthal, K. Addis		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	Number of Containers	VOCs EPA 8260C	TOC EPA 415.1	MEE RSK-175	Ferrous Iron 3500-FED	Metals (dissolved)** As & Mn only	Anions EPA 300.0 (NO_3 & SO_4)	VFA organic acids (by MI)	qDHC bacterial census (by MI)	Notes/Comments
					Analysis Requested								** dissolved metals are field filtered; ⊗ = Non preserved VOA
GW-110118-PP-1B-I-0	1/18/11	0834	GW	5	⊗	X			X				
GW-110118-PL2-021A-0		0915		13	X	X	X	X	X	X	X	X	500ml filtered
GW-110118-PL2-021A-1		0920		13	X	X	X	X	X	X	X	X	500ml filtered
GW-110118-PL2-021B-0		1037		5	X	X			X				
GW-110118-PL2-021C-0		1111		5	⊗	X			X				
GW-110118-PL2-031A-0		1203		12	X	X	X	X	X	X	X		
GW-110118-PL2-041AA-0		1255		4	X				X				
GW-110118-PL2-008C-0		1333		4	⊗				X				
GW-110118-PL2-008B-0		1400	↓	5	X	X			X				
Trip Blank	↓	—	—	2	X								

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
No more Microbial Insights samples.	Printed Name: Josh Bernthal	Printed Name: A. Volgardsen	Printed Name:	Printed Name:
	Company: EPI	Company: ARI	Company:	Company:
	Date & Time: 1-18-11 1440	Date & Time: 1/18/11 1440	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: SF22	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: **Boeing**	Phone:	Date: 1/19/11	Ice Present?
Client Contact: **Will Ernst**		No. of Coolers:	Cooler Temps:
Client Project Name: **2-66 ERD IM Performance Sampling**			
Client Project #: 17513	Samplers: J. Bernthal, K. Addis		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	Number of Containers	VOCs EPA 8260C	TOC EPA 415.1	MEE RSK-175	Ferrous Iron 3500-FED	Metals (dissolved)** As & Mn only	Anions EPA 300.0 (NO_3 & SO_4)	VFA organic acids (by MI)	qDHC bacterial census (by MI)	Notes/Comments
					Analysis Requested								** dissolved metals are field filtered; ⊗ = Nonpreserved VOA's
GW-110119-PP-3A-I-0	1/19/11	0830	GW	5	X	X			X				
GW-110119-PP-3B-I-0		0904		5	⊗	X			X				
GW-110119-PL2-0100A-0		0937		5	X	X			X				
GW-110119-PL2-035A-0		1022		9	X	X	X	X	X				
GW-110119-PP-2B-O-0		1055		4	⊗				X				
GW-110119-PP-2B-I-0		1119		5	⊗	X			X				
GW-110119-PP-2B-I-1		1124		5	⊗	X			X				
GW-110119-PP-4B-I-0		1211		5	⊗	X			X				
GW-110119-PP-4B-O-0		1254	↓	4	⊗				X				
Trip Blank	↓	—	—	2	X								

Comments/Special Instructions: No more samples to follow.

Relinquished by: (Signature)		Received by: (Signature)	
Printed Name: Josh Bernthal		Printed Name: Mikal Columba	
Company: RPI		Company: ARI	
Date & Time: 1-19-11 1345		Date & Time: 1/19/11 1345	
Relinquished by: (Signature)		Received by: (Signature)	
Printed Name:		Printed Name:	
Company:		Company:	
Date & Time:		Date & Time:	

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Boeing Plant 2, 2-66 IM Sheetpile Injection Monitoring Wells
Water Levels

Well	Date	Time	Depth to Water (ft)
PL2-010A	4|18|11	10:29	9.98
PL2-017A	4|18|11	10:08	9.80
PL2-021A	4|18|11	11:03	10.46
PL2-021B	4|18|11	11:00	10.68
PL2-021C	4|18|11	10:57	10.48
PL2-031A	4|18|11	10:25	9.44
PL2-032A	4|18|11	10:00	10.35
PL2-035A	4|18|11	10:54	10.39
PL2-041AA	4|18|11	10:11	9.88
PL2-008B	4|18|11	10:21	10.52
PL2-008C	4|18|11	10:17	11.67
PP-1B-I	4|18|11	10:51	10.81
PP-2B-I	4|18|11	10:48	12.07
PP-2B-O	4|18|11	10:45	13.86
PP-3A-I	4|18|11	10:35	9.98
PP-3B-I	4|18|11	10:32	10.24
PP-4B-I	4|18|11	10:37	11.57
PP-4B-O	4|18|11	10:39	13.14
PP-5B-I	4|18|11	10:04	10.12

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-608B	Date	4/18/11
Sample: ID	GW-110418-PL2-608B-0	Field Team: (Initials)	JB
Field Conditions	Sunny + clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.71
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	1144
End Time	1222
Total Gallons Purged	2.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1157	.7	6.60	3.743 mS/cm c	12.68	1.48 mg/L	13.15	-15.5	10.71	clear
1200	.9	6.60	3.733 mS/cm c	9.81	1.23 mg/L	13.32	-22.2	10.74	clear
1203	1.1	6.58	3.734 mS/cm c	8.86	1.05 mg/L	13.40	-27.6	10.78	clear
1206	1.3	6.55	3.736 mS/cm c	7.71	0.95 mg/L	13.46	-31.5	10.81	clear
1209	1.5	6.55	3.736 mS/cm c	6.81	0.86 mg/L	13.61	-35.1	10.84	clear
1212	1.7	6.54	3.737 mS/cm c	6.99	0.81 mg/L	13.68	-38.4	10.87	clear
1215	1.9	6.55	3.741 mS/cm c	6.51	0.75 mg/L	13.70	-41.3	10.89	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1217	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1217	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1217	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1222

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-008C	Date	4/8/11
Sample: ID	GW-110418-PL2-008C-0	Field Team: (Initials)	JB
Field Conditions	Sunny + clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	12.32
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: _____

Start Time	1229
End Time	1255
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1233	.7	7.66	5.965 mS/cm	3.91	0.44 mg/L	13.69	-77.5	12.32	clear/yellow
1236	.9	7.75	5.963 mS/cm	2.16	0.44 mg/L	13.68	-85.6	12.32	clear/yellow
1239	1.1	7.80	5.963 mS/cm	1.17	0.44 mg/L	13.71	-93.9	12.32	clear/yellow
1242	1.3	7.85	5.967 mS/cm	1.37	0.44 mg/L	13.64	-99.1	12.32	clear/yellow
1245	1.5	7.91	5.966 mS/cm	1.06	0.43 mg/L	13.63	-103.6	12.32	clear/yellow
1248	1.7	7.91	5.960 mS/cm	0.87	0.45 mg/L	13.64	-106.2	12.32	clear/yellow

Sample Information

Sample Method(s): **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1250	(3) 40-mL VOA	~~HCl, cool to 4°C~~	NOT PRESERVED
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1250	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time: 1255

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-041AA	Date	4/18/11
Sample: ID	GW-110418-PL2-041AA-0	Field Team: (Initials)	JB
Field Conditions	Sunny & clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.39
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	1312
End Time	1347
Total Gallons Purged	2.3 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1322	.7	8.20	0.876 mS/cm	3.74	0.56 mg/L	12.25	-22.2	10.39	clear
1325	.9	8.05	0.896 mS/cm	2.61	0.50 mg/L	12.21	-26.0	10.40	clear
1328	1.1	7.96	0.908 mS/cm	3.11	0.49 mg/L	12.22	-29.0	10.42	clear
1331	1.3	7.85	0.915 mS/cm	3.61	0.50 mg/L	12.21	-29.5	10.43	clear
1334	1.5	7.79	0.919 mS/cm	2.16	0.50 mg/L	12.29	-30.3	10.44	clear
1337	1.7	7.75	0.923 mS/cm	1.67	0.51 mg/L	12.29	-32.0	10.45	clear
1340	1.9	7.71	0.927 mS/cm	1.63	0.54 mg/L	12.36	-33.0	10.46	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1345	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1345	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time: 1347

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-4B-I	Date	4/8/11
Sample: ID	GW-110413-PP-4B-I-0	Field Team: (Initials)	JB
Field Conditions	Sunny + clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	12.21
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1349
End Time	1418
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1358	.6	6.85	4.169 mS/cm		0.45 mg/L	14.58	-43.7	12.25	clear
1401	.8	6.83	4.196 mS/cm		0.47 mg/L	14.55	-55.1	12.26	clear
1404	1.0	6.79	4.329 mS/cm		0.52 mg/L	14.53	-61.1	12.27	clear
1407	1.2	6.77	4.332 mS/cm		0.56 mg/L	14.55	-61.8	12.28	clear
1410	1.4	6.77	4.222 mS/cm		0.59 mg/L	14.59	-62.6	12.29	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1414	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1414	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1414	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1418

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-4B-0	Date	4/18/11
Sample: ID	GW-110418-PP4B-0-0	Field Team: (Initials)	JB
Field Conditions	Sunny + clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	12.83
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	1423
End Time	1451
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1433	.7	6.70	4.255 mS/c	2.91	0.46 mg/L	15.37	-57.2	12.84	clear
1436	.9	6.74	4.341 mS/c	1.71	0.50 mg/L	15.31	-59.3	12.84	clear
1439	1.1	6.76	4.353 mS/c	1.53	0.52 mg/L	15.28	-61.2	12.84	clear
1442	1.3	6.76	4.360 mS/c	1.37	0.56 mg/L	15.20	-62.3	12.84	clear
1445	1.5	6.76	4.366 mS/c	1.89	0.58 mg/L	15.23	-63.0	12.84	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1447	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1447	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1451

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-1B-I	Date	4/19/11
Sample: ID	66-110419-PP1B-I-O	Field Team: (Initials)	JB
Field Conditions	Cloudy & Cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.33
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	0704
End Time	0800
Total Gallons Purged	3.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0721	1.2	6.25	11.07 mS/cm	11.8	1.41 mg/L	12.42	-43.0	10.27	Bubbly/color
0724	1.4	6.29	11.36 mS/cm	23.6	1.21 mg/L	12.53	-51.2	10.27	Bubbly/dark
0727	1.6	6.33	11.28 mS/cm	16.0	1.05 mg/L	12.53	-58.3	10.27	Bubbly/dark
0730	1.8	6.39	11.66 mS/cm	14.0	0.95 mg/L	12.54	-62.7	10.27	Bubbly/brown
0733	2.0	6.49	11.90 mS/cm	13.5	0.37 mg/L	12.78	-68.4	10.27	Bubbly/dark
0736	2.2	6.54	11.95 mS/cm	13.4	0.81 mg/L	12.85	-72.3	10.28	Bubbly/dark
0739	2.4	6.57	11.89 mS/cm	12.7	0.76 mg/L	12.86	-75.9	10.27	Bubbly/dark
0742	2.6	6.59	11.87 mS/cm		0.71 mg/L	12.91	-78.2	10.29	Bubbly/dark

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0743	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0743	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0743	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0800

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-021B	Date	4/19/11
Sample: ID	GW-110419-PL2-021B-0	Field Team: (Initials)	JR
Field Conditions	Cloudy + cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.85
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / Peristaltic Pump (circled) / Other:

Start Time	0807
End Time	0900
Total Gallons Purged	3.4 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0820	.8	7.05	5.012 mS/cm	4.07	1.39 mg/L	12.91	-73.0	9.92	clear
0823	1.0	7.00	5.047 mS/cm	8.83	1.14 mg/L	12.92	-76.3	9.94	clear
0826	1.2	6.97	5.069 mS/cm	5.00	1.01 mg/L	12.97	-79.1	9.96	clear
0829	1.4	6.90	5.129 mS/cm	4.06	0.91 mg/L	12.98	-81.2	9.97	clear
0832	1.6	6.90	5.235 mS/cm	19.8	0.83 mg/L	12.99	-82.0	9.98	clear
0835	1.8	6.85	5.937 mS/cm	9.92	0.79 mg/L	12.93	-86.7	9.99	clear
0838	2.0	6.80	6.560 mS/cm	7.04	0.70 mg/L	12.90	-88.0	9.99	clear
0841	2.2	6.78	6.919 mS/cm	9.11	0.63 mg/L	12.92	-89.1	9.99	clear
0844	2.4	6.76	7.114 mS/cm	4.30	0.60 mg/L	12.95	-89.5	9.99	clear
0847	2.6	6.74	7.239 mS/cm	11.1	0.57 mg/L	12.97	-89.7	9.99	clear
0850	2.8	6.73	7.316 mS/cm	9.18	0.55 mg/L	12.96	-91.0	10.00	clear
0853	3.0	6.73	7.373 mS/cm	4.08	0.52 mg/L	13.00	-91.6	10.01	clear

Sample Information

Sample Method(s) : Peristaltic pump (circled) / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0855	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0855	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0855	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0900

Comments / Exceptions:

Presence of floating product? YES / NO (circled) Presence of sinking product? YES / NO (circled)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-021A	Date	4/19/11
Sample: ID	GW-110419-PL2-021-0	Field Team: (Initials)	JB
Field Conditions	Cloudy + cool		

Purge Information

Well Diameter (in.)	4"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.91
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	0905
End Time	1045
Total Gallons Purged	2.0 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0915	.7	6.61	2.173 mS/cm	10.89	0.75 mg/L	11.60	-73.4	9.99	clear
0918	.9	6.59	2.16 mS/cm	12.1	0.80 mg/L	11.59	-75.5	10.02	clear
0921	1.1	6.49	2.16 mS/cm	10.77	0.80 mg/L	11.69	-77.0	10.05	clear
0924	1.3	6.46	2.16 mS/cm	9.81	0.75 mg/L	11.60	-78.0	10.07	clear
0927	1.5	6.74	2.164 mS/cm	9.73	0.70 mg/L	11.60	-78.4	10.09	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / ~~Submersible pump~~ / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0930	(3) 40-mL VOA	HCl, cool to 4°C	~~MS/MSD~~ RB
TOC (415.1)	0930	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	MS RB
Dissolved gasses (MEE) (RSK-175)	0930	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	0930	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	0930	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	0930	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0930	(1) 500 mL HDPE	field filter, HNO_3	
Census	0930	bio-flo&MI falcon tube	cool to 4°C	500mL Filtered

End Time 1045

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-017A	Date	4/19/11
Sample: ID	GW-110419-PL2-017A-0.1 (MS/MSD)	Field Team: (Initials)	JG
Field Conditions	Sunny + Cool		

Purge Information

Well Diameter (in.)	4"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.24
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
~~Bladder Pump~~
Peristaltic Pump
Other: :

Start Time	1307
End Time	1450
Total Gallons Purged	2.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1322	.9	6.51	0.884mS/cm	12.2	5.46 mg/L	9.09	87.9	10.37	clear
1325	1.1	6.32	0.883mS/cm	9.83	5.25 mg/L	9.17	91.9	10.41	clear
1328	1.3	6.27	0.882mS/cm	5.81	5.03 mg/L	9.23	95.5	10.44	clear
1331	1.5	6.25	0.879mS/cm	2.80	4.87 mg/L	9.24	98.4	10.46	clear
1334	1.7	6.22	0.874mS/cm	10.48	4.72 mg/L	9.27	100.9	10.48	clear
1337	1.9	6.21	0.872mS/cm	9.62	4.62 mg/L	9.33	103.4	10.50	clear
1340	2.1	6.18	0.870mS/cm	5.84	4.53 mg/L	9.34	106.0	10.51	clear

Sample Information

Sample Method(s) : Peristaltic pump / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1400	(3) 40-mL VOA	HCl, cool to 4°C	MS/MSD
TOC (415.1)	1400	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	MS/MSD
Dissolved gasses (MEE) (RSK-175)	1400	(3) 40-mL VOA	cool to 4°C	MS/MSD
Ferrous Iron (SM3500 Fe B-97)	1400	250 mL amber	cool to 4°C Do NOT filter	MS/MSD
Anions (EPA 300.0)	1400	(1) 500 mL HDPE	cool to 4°C	MS/MSD
Organics Acids (VFA)	1400	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	MS/MSD
Metals (200.8&6010B)	1400	(1) 500 mL HDPE	field filter, HNO_3	MS/MSD
Census	1400	bio-flo&MI falcon tube	cool to 4°C	Duplicate @ 1430

End Time 1450

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PLZ-021C	Date	4/20/11
Sample: ID	GW-110420-PLZ-021C-0	Field Team: (Initials)	JB
Field Conditions	clear & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	11.23
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	0803
End Time	0837
Total Gallons Purged	2.2 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0813	.7	7.53	23.10 mS/cm	22.5	1.54 mg/L	13.57	-157.0	11.34	clear
0816	.9	7.61	23.01 mS/cm	21.4	1.22 mg/L	13.68	-166.0	11.37	clear
0819	1.1	7.67	23.06 mS/cm	23.4	1.03 mg/L	13.75	-173.1	11.39	clear
0822	1.3	7.71	23.06 mS/cm	11.9	0.90 mg/L	13.80	-176.7	11.41	clear
0825	1.5	7.74	23.06 mS/cm	9.95	0.81 mg/L	13.85	-179.0	11.43	clear
0829	1.7	7.76	23.07 mS/cm	9.37	0.76 mg/L	13.88	-180.7	11.45	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0832	(3) 40-mL VOA	HCl, cool to 4°C	NOT PRESERVED
TOC (415.1)	0832	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0832	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0837

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-032A	Date	4/20/11
Sample: ID	GW-110420-PL2-032A-0,1	Field Team: (Initials)	JB
Field Conditions	Clear & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.85
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	1025
End Time	1130
Total Gallons Purged	2.3 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1035	1.7	7.27	2.366 mS/cm	18.6	0.71 mg/L	11.70	-49.9	9.99	clear
1038	1.9	7.18	2.363 mS/cm	13.0	0.85 mg/L	11.80	-51.4	10.00	clear
1041	1.1	7.14	2.363 mS/cm	14.4	0.97 mg/L	11.83	-52.1	10.01	clear
1044	1.3	7.09	2.363 mS/cm	10.66	1.13 mg/L	11.89	-53.8	10.02	clear
1047	1.5	7.05	2.364 mS/cm	12.0	1.23 mg/L	12.00	-54.9	10.03	clear
1050	1.7	7.03	2.365 mS/cm	14.3	1.25 mg/L	12.08	-55.8	10.04	clear
1053	1.9	7.00	2.366 mS/cm	7.82	1.22 mg/L	12.02	-56.0	10.06	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1101	(3) 40-mL VOA	HCl, cool to 4°C	Duplicate @ 1111
TOC (415.1)	1101	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	Duplicate @ 1111
Dissolved gasses (MEE) (RSK-175)	1101	(3) 40-mL VOA	cool to 4°C	Duplicate @ 1111
Ferrous Iron (SM3500 Fe B-97)	1101	250 mL amber	cool to 4°C Do NOT filter	Duplicate @ 1111
Anions (EPA 300.0)	1101	(1) 500 mL HDPE	cool to 4°C	Duplicate @ 1111
Organics Acids (VFA)	1101	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	Duplicate @ 1111
Metals (200.8&6010B)	1101	(1) 500 mL HDPE	field filter, HNO_3	Duplicate @ 1111
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1130

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-5B.I	Date	4/20/11
Sample: ID	GW-110420 PP-5B-I-0	Field Team: (Initials)	JB
Field Conditions	clear & cool		

Purge Information

Well Diameter (in.)	0902
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.60
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	0902
End Time	1023
Total Gallons Purged	5.4 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0912	.7	9.51	0.214 mS/cm	16.3	3.08 mg/L	12.37	-23.0	10.63	clear
0915	.9	9.34	0.211 mS/cm	5.10	2.32 mg/L	12.39	-19.5	10.67	clear
0918	1.1	9.17	0.210 mS/cm	6.75	2.70 mg/L	12.40	-16.4	10.69	clear
0927	1.3	8.80	0.210 mS/cm	6.90	2.33 mg/L	12.51	-13.6	10.71	clear
0930	1.5	8.67	0.211 mS/cm	2.46	2.21 mg/L	12.58	-17.0	10.72	clear
0940	2.5	8.33	0.231 mS/cm	6.51	1.37 mg/L	12.82	-44.6	10.77	clear
0943	2.7	8.24	0.237 mS/cm	9.25	1.31 mg/L	12.83	-45.3	10.78	clear
0944	3.3	8.05	0.311 mS/cm	4.77	1.08 mg/L	12.94	-43.4	10.78	clear
0952	3.5	7.86	0.541 mS/cm	5.58	0.98 mg/L	12.99	-37.7	10.8	clear
1006	4.5	7.19	17.00 mS/cm	2.52	0.49 mg/L	13.15	-54.9	10.81	clear
1009	4.7	7.24	17.29 mS/cm	7.88	0.46 mg/L	13.15	-61.5	10.82	clear
1012	4.9	7.27	17.34 mS/cm	3.16	0.44 mg/L	13.18	-66.4	10.82	clear
1015	5.1	7.30	17.41 mS/cm	5.41	0.42 mg/L	13.20	-70.1	10.83	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1016	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1016	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1016	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1023

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-031A	Date	4/22/11
Sample: ID	GW-110420-PL2-031A-0	Field Team: (Initials)	JB
Field Conditions	Sunny & Clear		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.37
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	1133
End Time	1230
Total Gallons Purged	1.6 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1143	.6	7.99	0.601 mS/cm	6.63	0.81 mg/L	11.59	-16.7	9.47	clear
1146	.8	7.97	0.601 mS/cm	3.34	0.66 mg/L	11.60	-18.0	9.48	clear
1149	1.0	7.96	0.601 mS/cm	4.50	0.58 mg/L	11.64	-18.4	9.49	clear
1152	1.2	7.96	0.601 mS/cm	4.89	0.52 mg/L	11.62	-19.0	9.50	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1210	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1210	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	1210	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	1210	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)	1210	(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)	1210	(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1210	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1230

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-3A-I	Date	4/20/11
Sample: ID	GW-110420-PP-3A-I-0	Field Team: (Initials)	TB
Field Conditions	Sunny + cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.25
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other:

Start Time	1256
End Time	1331
Total Gallons Purged	2.5 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1308	.7	7.08	3.114 mS/cm	6.33	2.85 %	13.77	-44.9	10.25	clear
1311	.9	7.09	3.131 mS/cm	4.45	1.79 %	13.74	-50.3	10.26	clear
1314	1.1	7.05	3.128 mS/cm	5.63	1.49 mg/L	13.75	-53.4	10.26	clear
1317	1.3	7.03	3.115 mS/cm	5.57	1.33 %	13.72	-55.9	10.27	clear
1320	1.5	7.03	3.089 mS/cm	5.71	1.23 %	13.69	-57.6	10.27	clear
1323	1.7	7.05	3.089 mS/cm	7.46	1.15 mg/L	13.68	-59.1	10.25	clear
1326	1.9	7.05	3.079 mS/cm	5.80	1.09 mg/L	13.68	-60.2	10.28	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1329	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1329	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1329	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time: 1331

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-3B-I	Date	4/26/11
Sample: ID	GW-110420-PP-3B-I-D	Field Team: (Initials)	JB
Field Conditions	Sunny & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.75
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** (circled) / Other: :

Start Time	1334
End Time	1410
Total Gallons Purged	1.7 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1344	.6	7.16	11.19 mS/cm	8.37	0.57 mg/L	13.88	-55.6	10.82	clear
1347	.8	7.19	11.19 mS/cm	11.4	6.56 mg/L	13.85	-60.1	10.85	clear
1350	1.0	7.24	11.19 mS/cm	2.30	0.58 mg/L	13.83	-63.9	10.85	clear
1353	1.2	7.26	11.19 mS/cm	9.13	0.59 mg/L	13.88	-66.9	10.91	clear

Sample Information

Sample Method(s) : **Peristaltic pump** (circled) / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1400	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	1400	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1400	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1410

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PLZ-010A	Date	4/21/11
Sample: ID	GU-110421-PLZ-010A-0	Field Team: (Initials)	JB
Field Conditions	Partly Sunny, cool		

Purge Information

Well Diameter (in.)	4"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.11
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / ~~Bladder Pump~~ / **Peristaltic Pump** / Other: :

Start Time	0757
End Time	0832
Total Gallons Purged	2.2 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0806	0.6	6.39	0.986 mS/cm	6.80	3.58 mg/L	12.99	82.1	9.20	clear
0809	0.8	6.30	0.981 mS/cm	5.56	3.10 mg/L	13.04	88.0	9.22	clear
0812	1.0	6.23	0.983 mS/cm	6.29	2.85 mg/L	12.86	93.4	9.23	clear
0815	1.2	6.18	0.982 mS/cm	8.48	2.70 mg/L	12.71	98.0	9.24	clear
0818	1.4	6.13	0.980 mS/cm	7.16	2.58 mg/L	12.65	102.6	9.25	clear
0821	1.6	6.09	0.980 mS/cm	9.39	2.49 mg/L	12.60	107.1	9.26	clear
0824	1.8	6.07	0.976 mS/cm	8.18	2.43 mg/L	12.56	110.3	9.27	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0827	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0827	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0827	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0832

Comments / Exceptions:

Presence of floating product? YES / NO Presence of sinking product? YES / NO

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PL2-035A	Date	4/21/14
Sample: ID	GW-110421-PL2-035A-0	Field Team: (Initials)	JB
Field Conditions	Partly sunny, cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.25
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	0839
End Time	0917
Total Gallons Purged	2.2 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0848	1.0	6.47	2.561 mS/cm	11.8	1.26 mg/L	13.56	-1.7	9.26	clear
0851	1.2	6.49	2.567 mS/cm	7.04	1.06 mg/L	13.66	-7.1	9.26	clear
0854	1.4	6.52	2.566 mS/cm	7.38	0.92 mg/L	13.59	-11.6	9.26	clear
0857	1.6	6.52	2.566 mS/cm	13.3	0.85 mg/L	13.65	-15.3	9.26	clear
0900	1.8	6.54	2.568 mS/cm	3.69	0.79 mg/L	13.68	-18.9	9.27	clear

Sample Information

Sample Method(s) **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	0907	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)	0907	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)	0907	(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)	0907	250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	0907	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 0917

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-2B-I	Date	4/21/11
Sample: ID	GW-110421-PP-2B-I-0,1	Field Team: (Initials)	JB
Field Conditions	Sunny & cool		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	9.57
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump / Bladder Pump / **Peristaltic Pump** / Other: :

Start Time	0932
End Time	1026
Total Gallons Purged	2.2 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
0956	1.4	6.84	4.846 mS/cm	13.5	1.59 mg/L	13.70	-54.8	9.66	clear
0959	1.6	6.83	4.874 mS/cm	11.3	1.24 mg/L	13.73	-55.3	9.66	clear
1002	1.8	6.83	4.883 mS/cm	9.56	1.05 mg/L	13.86	-56.5	9.67	clear
1005	2.0	6.84	4.876 mS/cm	12.3	0.94 mg/L	13.86	-57.8	9.67	clear
1008	2.2	6.84	4.886 mS/cm	9.86	0.86 mg/L	13.85	-58.7	9.68	clear
1011	2.4	6.84	4.896 mS/cm	9.29	0.78 mg/L	13.81	-59.6	9.69	clear

Sample Information

Sample Method(s) : **Peristaltic pump** / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1015	(3) 40-mL VOA	HCl, cool to 4°C	Duplicate @ 1021
TOC (415.1)	1015	250 mL amber	H_2SO_4 to pH <2, cool to 4°C	Duplicate @ 1021
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1015	(1) 500 mL HDPE	field filter, HNO_3	Duplicate @ 1021
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time: 1026

Comments / Exceptions:

Presence of floating product? YES / **NO** Presence of sinking product? YES / **NO**

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

2-66 Sheetpile Structure IM Groundwater Sampling Field Data

Boeing Plant 2, Seattle/Tukwila, Washington

Station	PP-2B-O	Date	4/21/11
Sample: ID	GW-110421-PP-2B-O-O	Field Team: (Initials)	JB
Field Conditions	Clear & (ool)		

Purge Information

Well Diameter (in.)	2"
Well Depth (ft.)	
Initial Depth to Water (ft.)	10.40
Depth of Water Column	
3 Casing Volumes	
1 Casing Volume	

Purge Method : Submersible pump
Bladder Pump
Peristaltic Pump
Other: :

Start Time	1032
End Time	1115
Total Gallons Purged	1.9 gallons

Time	Gallons	pH	Conductivity	NTU	DO	Temp.	ORP	Water Level	Appearance
1041	.6	7.11	3.329 mS/cm	31.7	1.34 mg/L	14.44	23.4	10.45	clear
1044	.8	7.08	3.330 mS/cm	21.4	1.23 mg/L	14.57	23.9	10.47	clear
1047	1.0	7.06	3.330 mS/cm	16.9	1.16 mg/L	14.61	23.1	10.48	clear
1050	1.2	7.04	3.332 mS/cm	11.1	1.08 mg/L	14.62	20.4	10.49	clear
1053	1.4	7.03	3.336 mS/cm	8.62	1.03 mg/L	14.54	17.4	10.50	clear

Sample Information

Sample Method(s) Peristaltic pump / Submersible pump / Bladder Pump / Other

Analysis	Time	Bottle Type	Preservative/Filtration	Comments
Volatiles (8260B)	1106	(3) 40-mL VOA	HCl, cool to 4°C	
TOC (415.1)		250 mL amber	H_2SO_4 to pH <2, cool to 4°C	
Dissolved gasses (MEE) (RSK-175)		(3) 40-mL VOA	cool to 4°C	
Ferrous Iron (SM3500 Fe B-97)		250 mL amber	cool to 4°C Do NOT filter	
Anions (EPA 300.0)		(1) 500 mL HDPE	cool to 4°C	
Organics Acids (VFA)		(1) 500 mL poly	field filter 0.45 micron filter, HNO_3 to pH <2, cool to 4°C	
Metals (200.8&6010B)	1106	(1) 500 mL HDPE	field filter, HNO_3	
Census		bio-flo&MI falcon tube	cool to 4°C	

End Time 1115

Comments / Exceptions:

Presence of floating product? YES / (NO) Presence of sinking product? YES / (NO)

Notes: Where multiple visits are required to complete sampling, parameters are to be checked prior to sampling for each visit. Enter data under field comments.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5538	Turn-around Requested:	Page: 1 of 1	
ARI Client Company: Boeing	Phone:	Date: 4/18/11	Ice Present? Y
Client Contact: Will Ernst		No. of Coolers: 1	Cooler Temps: 10.5
Client Project Name: 2-66 ERD IM Performance Sampling			
Client Project #: 17513	Samplers: J. Bernthal		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: EPA 8260C VOCs	EPA 415.1 TOC	Metals (dissolved) As & Mn only						Notes/Comments
GW-110418-PL2-003B-0	4/18/11	1217	H_2O	5	X	X	X						* dissolved metals are field filtered
GW-110418-PL2-003C-0	4/18/11	1250	H_2O	4	⊗		X						⊗ Nonpreserved VOAs
GW-110418-PL2-041AA-0	4/18/11	1345	H_2O	4	X		X						
GW-110418-PP-48-Z-0	4/18/11	1414	H_2O	5	X	X	X						
GW-110418-PP-48-0-0	4/18/11	1447	H_2O	4	X		X						
TRIP BLANK	4/18/11	—	H_2O	2	X								

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Josh Bernthal	Printed Name: A. Volgardsen	Printed Name:	Printed Name:
	Company: EPI	Company: ARI	Company:	Company:
	Date & Time: 4/18/11 1535	Date & Time: 4/18/11 1535	Date & Time:	Date & Time:

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: SS604	Turn-around Requested:	Page: 1 of 1	
ARI Client Company: Boeing	Phone:	Date: 4/19/11	Ice Present?
Client Contact: WILL ERNST		No. of Coolers:	Cooler Temps:
Client Project Name: Z-66 ERD IM Performance Sampling			
Client Project #: 17513	Samplers: J. Bernthal		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: VOCs EPA 8260C	TOC EPA 415.1	MEE RSK-175	Ferrous Iron 3500-FED	Metals (dissolved) As + Mn only	Anions EPA 300.0 (NO3 + SO4)	VFA organic acids (by HPLC)	qPHC bacterial Census (by HPLC)	Notes/Comments
GW-110419-PP-1B-I-0	4/19/11	0743	GW	5	X	X			X				
GW-110419-PL2-021B-0	4/19/11	0855	GW	5	X	X			X				
GW-110419-PL2-021A-0	4/19/11	0930	GW	13	X	X	X	X	X	X	X	X	500mL FILTERED
GW-110419-PL2-017A-0	4/19/11	1400	GW	37	X	X	X	X	X	X	X	[X]	MS/MSD IL FILTERED
GW-110419-PL2-017A-1	4/19/11	1430	GW	1								X	IL FILTERED
TRIP BLANK	4/18/11	—	—	2	X								

KEY: dissolved metals are field filtered
⊗ = Non-preserved VOAs
[X] = Not MS/MSD

Comments/Special Instructions	Relinquished by: (Signature)	Printed Name	Company	Date & Time	Received by: (Signature)	Printed Name	Company	Date & Time
No more Microbial Insights samples. More Samples to follow		Josh Bernthal	EPI	4/19/11 1540		Jennifer Millsap	ARI	4/19/11 1540
	Relinquished by: (Signature)	Printed Name:	Company:	Date & Time:	Received by: (Signature)	Printed Name:	Company:	Date & Time:

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5594	Turn-around Requested:	Page: 1 of 1	
ARI Client Company: Boeing	Phone:	Date: 4/20/11	Ice Present? Y
Client Contact: Will Ernst		No. of Coolers: 1	Cooler Temps: 10.9
Client Project Name: 2-66 ERD IM Performance Sampling			
Client Project #: 17513	Samplers: J. Bernthal		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	VOCs EPA 8260C	TOC EPA 415.1	MEE RSK-175	Ferrous Iron 3500-FED	Metals (dissolved) #4 As & Mn only	Anions EPA 300.0 (NO3 & SO4)	VFA organic acids (6 ea MI)		Notes/Comments
													#'s dissolved metals are field filtered
													@ Non Preserved VOA's
GW-110420-PL2-021C-0	4/20/11	0832	GW	5	⊗	X			X				
GW-110420-PP-5B-I-0	4/20/11	1016	GW	5	X	X			X				
GW-110420-PL2-032A-0	4/20/11	1101	GW	12	X	X	X	X	X	X	X		
GW-110420-PL2-032A-1	4/20/11	1111	GW	12	X	X	X	X	X	X	X		
GW-110420-PL2-034A-0	4/20/11	1210	GW	12	X	X	X	X	X	X	X		
GW-110420-PP-3A-I-0	4/20/11	1329	GW	5	X	X			X				
GW-110420-PP-3B-I-0	4/20/11	1400	GW	5	X	X			X				
Trip Blank	4/18/11	—	—	2	X								

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
More Samples to follow	Printed Name: Josh Bernthal	Printed Name: Taylor Streeter	Printed Name:	Printed Name:
	Company: EPI	Company: ARI	Company:	Company:
	Date & Time: 4/20/11 1510	Date & Time: 4/20/11 1510	Date & Time:	Date & Time:

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5102	Turn-around Requested:
ARI Client Company: Boeing	Phone:
Client Contact: Will Ernst	
Client Project Name: 2-66 ERD IM Performance Sampling	
Client Project #: 17513	Samplers: J. Bernthal

Page: 1 of 1	
Date: 4/21/11	Ice Present? Y
No. of Coolers: 1	Cooler Temps: 4.3

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: VOCs 8260C	TOC EPA 415.1	MEE RSK-175	3560 Ferrous Iron FEO	As + Mn only Metals (dissolved)*				Notes/Comments
GW-110421-PLZ-01BA-0	4/21/11	0827	GW	5	X	X			X				*=dissolved metals are field filtered
GW-110421-PLZ-035A-0	4/21/11	0907	GW	9	X	X	X	X	X				
GW-110421-PP-2B-I-0	4/21/11	1015	GW	5	X	X			X				
GW-110421-PP-2B-I-1	4/21/11	1021	GW	5	X	X			X				
GW-110421-PP-2B-O-0	4/21/11	1106	GW	4	X				X				
Trip Blank	4/19/11	—	—	2	X								

Comments/Special Instructions: No More Samples to follow.	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)	
	Printed Name: Josh Bernthal	Printed Name:	Printed Name:	Printed Name:	
	Company: EPI	Company: ARI	Company:	Company:	
	Date & Time: 4/21/11 1245	Date & Time: 4/21/11 1245	Date & Time:	Date & Time:	

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

ATTACHMENT D

DATA VALIDATION REPORTS

TECHNICAL MEMORANDUM

Date:	February 7, 2011	**Project No.:**	013-1646-011.700.01
To:	Will Ernst	**Company:**	The Boeing Company
From:	Jill Lamberts, Staff Environmental Scientist Kent Angelos, Principal and Project Director		
cc:	Jeff Dengler and Doug Kunkel, EPI	**Email:**	jill_lamberts@golder.com

RE: BOEING PLANT 2 – 2-66 ERD IM – DATA VALIDATION QA/QC REVIEW – JANUARY 2011 SAMPLING ROUND

1.0 INTRODUCTION

A total of 24 water samples (including 2 field duplicates and 3 trip blanks) were collected January 17-19, 2011 as part of the Boeing Plant 2 Groundwater Interim Measures Work Plan for 2-66 ERD IM (EPI, 2008). Samples were analyzed by Analytical Resources Incorporated (ARI) of Tukwila, Washington, Microbial Insights of Rockford, Tennessee, and Microseeps of Pittsburg, Pennsylvania for the following parameters:

- Volatile Organic Compounds (VOCs) by EPA Method 8260C
- Total Organic Carbon (TOC) by EPA 415.1
- Dissolved Gases (Methane, Ethane, and Ethene – MEE) by Modified RSK 175
- Dissolved Metals (Arsenic and Manganese) by EPA Methods 200.8 and 6010B
- Ferrous Iron by SM 3500 FeD
- Anions (N-Nitrate and Sulfate) by EPA 300.0
- Organic Volatile Fatty Acids (VFAs) (Pyruvic, Lactic, Acetic, Propionic, and Butyric Acids) by ion chromatography by Microseeps
- Bio-Dechlor Bacterial Census by qDHC (RT-PCR) – dehalococcoides by Microbial Insights

With the exception of the bacterial and metabolic acids analysis, samples were analyzed in accordance with procedures described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA SW-846, 3rd edition) 300.0, 415.1, 8260C, 6010B, metals, EPA Method 200.8, Revision 5.5; Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, Standard Methods for the Examination of Water and Wastewater (20th Edition)*.

The bacterial and metabolic acids analyses were analyzed in accordance with the *Microbial Insights and Microseeps Standard Operating Procedures*.

Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA
Tel: (425) 883-0777 Fax: (425) 882-5498 www.golder.com

2.0 SAMPLE DELIVERY GROUPS, SAMPLES AND ANALYSES

Samples were analyzed and results reported by the laboratory in batch numbers as summarized below:

SE88, P1101183, 0371A (VOCs, TOC, MEE, Ferrous Iron, Dissolved Metals, Anions, VGAs, and qDHC):

GW-110117-PL2-032A-0	GW-110117-PP-5B-I-0	GW-110117-PL2-017A-0
Trip Blank		

SF09, P1011182, 0371A (VOCs, TOC, MEE, Ferrous Iron, Dissolved Metals, Anions, VFAs, and qDHC):

GW-110118-PP-1B-I-0	GW-110118-PL2-021A-0	GW-110118-PL2-021A-1
GW-110118-PL2-021B-0	GW-110118-PL2-021C-0	GW-110118-PL2-031A-0
GW-110118-PL2-041AA-0	GW-110118-PL2-008C-0	GW-110118-PL2-008B-0
Trip Blank		

RS52 (VOCs, TOC, and Dissolved Metals):

GW-110119-PP-3A-I-0	GW-110119-PP-3B-I-0	GW-110119-PL2-010A-0
GW-110119-PL2-035A-0	GW-110119-PP-2B-O-0	GW-110119-PP-2B-I-0
GW-110119-PP-2B-I-1	GW-110119-PP-4B-I-0	GW-110119-PP-4B-O-0
Trip Blank		

Quality assurance/quality control (QA/QC) reviews of laboratory data were performed in the laboratory in accordance with the laboratory quality assurance program plan. The data validation QA/QC review focused primarily on laboratory result summary sheets and quality control summary sheets to ensure that work plan data quality objectives were met for the project.

Data validation was conducted in accordance with the criteria outlined in the National Functional Guidelines for Organic Data Review (EPA, 2008) and the National Functional Guidelines for Inorganic Data Review (EPA, 2010), modified to include method specific requirements of the laboratory analytical methods and *Interim Measure Work Plant for 2-66 Sheetpile, Boeing Plant 2 Seattle/Tukwila (EPI, 2008)*. Raw data sheets were reviewed as necessary to confirm conditions reported and to support application of qualifiers to analytical results

The validation level for the data is Level I, as described in the QAPP (EPI, 2008). The following is a summary of quality control elements associated with each analytical fraction and the status of that element as a result of the data validation process.

3.0 SAMPLING, DOCUMENTATION AND REPORTING

Sample acknowledgements, chain-of-custody, request forms and data package completeness were evaluated with the following noted:

- SDG SF09: Cooler receipt form indicates that two of two VOC vials for the Trip blank had small air bubbles. No action was required since the samples were all analyzed within the recommended holding time.

- SDG SF22: Cooler receipt form indicates that two of two VOC vials for the Trip blank, and three of three VOC vials for GW-110119-PP-2B-I-0 had small air bubbles. No action was required since the samples were all analyzed within the recommended holding time.
- Multiple SDGs: Some samples were preserved in the lab instead of the in the field or analyzed within a shortened hold time. No action was required since all samples were analyzed within recommended holding times.
- SDG SF09: The sample time for GW-110118-PL2-031A-0 was listed as 1203 on the chain of custody, but as 1155 on the bottles. The field staff was contacted and confirmed that the correct sample time is 1155.
- Results for volatile organic compound 1, 1, 2-trichloro-1, 2, 2-trifluoroethane are reported in a truncated format (1, 1, 2-trichloro-1, 2, 2-trifluoroe) due to ARI report format. No action was taken.

4.0 VOLATILE ORGANIC COMPOUNDS

Level 1 summary data packages were provided for the VOC analysis. The items reviewed during validation are summarized below.

4.1 Analytical Methods – *acceptable*

Samples for VOC analysis were analyzed by gas chromatography/mass spectrometry (GC/MS) using EPA SW846 Method 8260C. The QAPP lists the method for VOCs as 8260B. ARI updated their methods due to a NELAP audit and a memo dated 6/1/2009 was sent to Boeing, EPI, and Golder Project Managers informing them of the change.

4.2 Sample Holding Times and Preservations – *acceptable*

All samples were prepared and analyzed within 14 days of sample collection (preserved water samples) or within 7 days of sample collection (unpreserved water samples).

4.3 Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the approved quality assurance project plan (EPI, 2008) with the following exceptions:

- Quality assurance project plan (QAPP) reporting limits were not met for nine compounds. A review of current ARI detection limits shows that both method and reporting limits were updated (as of 6/1/2009). Compounds that do not meet QAPP stipulated reporting levels (RLs) are identified in the following table:

Table 1: 2-66 IM ERD VOC Reporting Limits

Compound	QAPP Table 6 RLs (µg/L)	Lab Reported RLs µg/L
Chloromethane	0.2	0.5
Bromomethane	0.2	1.0
Methylene Chloride	0.3	0.5
Acetone	3.0	5.0
2-Butanone	1.0	5.0

Compound	QAPP Table 6 RLs (µg/L)	Lab Reported RLs µg/L
Vinyl Acetate	0.5	1.0
2-Chloroethylvinylether	0.5	1.0
4-Methyl-2-Pentanone	1.0	5.0
2-Hexanone	1.0	5.0

- No action was taken; this change in the RLs was sent by ARI to Boeing, EPI, and Golder Project Managers on June 1, 2009 and subsequently approved and implemented as part of the June 2009 QAPP compendium (Golder, 2009).
- Trichloroethene is listed twice in QAPP Table 5. No action was taken.
- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds.

4.4 Instrument Calibration

Calibration review is not required under the QAPP; however, the lab provided information on the calibration performance in the case narratives. All of the calibration criteria were met with the following exception:

- SDG SE88: The continuing calibration standard (CCAL) on was out of control for 2-chloroethylvinylether. Associated samples were qualified as estimated (J/UJ) for this analyte.
- SDG SF22: The CCAL on 1/21/2011 was out of control for 2-chloroethylvinylether. Associated samples were qualified as estimated (J/UJ) for these analytes.

4.5 Blank Contamination – *acceptable*

The method blanks and trip blanks were free of contamination.

4.6 Surrogate Recovery – *acceptable*

All surrogate recoveries were within control limits.

4.7 Matrix Spike Compound Recovery

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) analysis was performed on GW-110117-PL2-017A-0 in SDG SE88. In SDGs where MS/MSD data are not available refer to LCS/LCSD and field duplicate data for precision and accuracy information. All MS/MSD recoveries and relative percent differences (RPDs) were acceptable with the following exception:

- SDG SE88: MS/MSD recoveries were out of control low for 2-chloroethylvinylether and styrene. The parent sample was qualified as estimated (U/UJ) for this analyte.

4.8 Laboratory Control Sample Recovery – *acceptable*

Laboratory control samples (LCS) were evaluated using control limits listed in Table 4 of the QAPP (EPI, 2008) and recently updated CLs on the ARI website. All LCS/LSCD recoveries and relative percent differences (RPDs) were acceptable.

4.9 Field Duplicate Sample Analysis – *acceptable*

Field duplicate samples were collected and analyzed as follows:

Table 2: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SF09	GW-110118-PL2-021A-0	GW-110118-PL2-021A-1
SF22	GW-110119-PP-2B-I-0	GW-110119-PP-2B-I-1

Field duplicate analysis criteria were met.

5.0 METHANE, ETHANE, AND ETHENE (MEE)

The laboratory provided Level I summary forms for compounds methane, ethane, and ethene. The items reviewed during validation are summarized below.

5.1 Analytical Methods – *acceptable*

Samples for MEE parameters were analyzed using EPA Method RSK-175 (Modified).

5.2 Sample Holding Times and Preservations

All samples were prepared and analyzed within the recommended holding times 14 days from collection to analysis. Please note that the QAPP stipulates that the hold time for MEE is 7 days. The lab was contacted to verify the hold time 5/11/2009. The lab responded that the QAPP was incorrect and the true hold time is 14 days. No action required other than to note.

5.3 Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the QA Plan with the following exception:

- Table 5 of the QAPP stipulates a reporting level of 1.0 µg/L for methane, ethane, and ethene. The ARI reporting limits are 0.7 µg/L for methane, 1.2 µg/L for ethane, and 1.1 µg/L for ethane. EPI's project manager was contacted and approved the slightly higher limits [personal comm. J. Dengler]. No further action was taken other than to note this.
- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.

5.4 Blank Contamination – *acceptable*

The method and equipment blanks were free of target compounds.

5.5 Surrogate Recovery – *acceptable*

All surrogate recoveries were within control limits.

5.6 Matrix Spike Compound Recovery – *acceptable*

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) analysis was performed on GW-110117-PL2-017A-0 in SDG SE88. In SDGs where MS/MSD data are not available refer to LCS/LCSD and field duplicate

data for precision and accuracy information. All MS/MSD recoveries and relative percent differences (RPDs) were acceptable.

5.7 Laboratory Control Sample Recovery – *acceptable*

Laboratory control samples (LCS) were evaluated and were within the control limits listed in the QAPP (EPI, 2008).

5.8 Field Duplicate Sample Analysis – *acceptable*

Field duplicate samples were collected and analyzed as follows:

Table 3: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SF09	GW-110118-PL2-021A-0	GW-110118-PL2-021A-1

Field duplicate analysis criteria were met.

6.0 INORGANICS – DISSOLVED METALS

The laboratory provided a provided a summary data package for review of metals analyses and the items reviewed during validation are summarized below.

6.1 Analytical Methods – *acceptable*

Samples for dissolved metals analysis were prepared using EPA Methods 3010A. Samples for dissolved metals analysis were completed by EPA Methods 200.8 for arsenic and EPA Method 6010B for manganese. No sampling, documentation, and reporting discrepancies were noted.

6.2 Sample Holding Times and Preservation – *acceptable*

All samples were prepared and analyzed within the recommended holding period from the date of collection (180 days for metals). All holding time criteria were met.

6.3 Laboratory Reporting Limits – *acceptable*

All metals listed in the Interim Measure Work Plan (2008) QAPP were analyzed for and requested reporting levels were met with the following discussion:

- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.

6.4 Blank Contamination – *acceptable*

The method blanks were free of target compounds.

6.5 Laboratory Control Sample Recovery – *acceptable*

LCS (blank spike) recoveries were within QC limits of 80 to 120 percent.

6.6 Matrix Spike/Matrix Spike Duplicate Analysis – *acceptable*

Matrix Spike (MS) analysis was performed on GW-110117-PL2-017A-0 in SDG SE88. In SDGs where MS data are not available refer to LCS, matrix duplicate, and field duplicate data for precision and accuracy information. All MS recoveries were acceptable.

6.7 Duplicate Analysis – *acceptable*

Laboratory duplicate analysis was performed on the same selected sample as for the MS analysis listed in the previous section. Duplicate analysis criteria were met.

6.8 Field Duplicate Sample Analysis

Field duplicate samples were collected and analyzed as follows:

Table 4: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SF09	GW-110118-PL2-021A-0	GW-110118-PL2-021A-1
SF22	GW-110119-PP-2B-I-0	GW-110119-PP-2B-I-1

Field duplicate analysis criteria were met.

7.0 GENERAL CHEMISTRY - TOTAL ORGANIC CARBON, FERROUS IRON, N-NITRATE AND SULFATE, VOLATILE FATTY ACIDS, AND BACTERIAL CENSUS

The laboratory (ARI) provided a Level I data package for analysis TOC, ferrous iron, and anions; the items reviewed during validation are summarized below. Microseeps provided a Level I data package for analysis of the organic volatile fatty acids (VFAs) and Microbial Insights provided the same for the bacterial census analysis.

7.1 Analytical Methods and Reporting – *acceptable*

The anions (N-Nitrate, and Sulfate) were analyzed using EPA method 300.0. Total Organic Carbon was analyzed by EPA Method 415.1. Ferrous Iron was analyzed by Standard Method 3500 FeD. Organic Volatile Fatty Acids (VFAs) (Pyruvic, Lactic, Acetic, Propionic, and Butyric) were analyzed by ion chromatography at Microseeps. The Bio-Dechlor Bacterial Census was analyzed by qDHC (RT-PCR) – dehalococcoides by Microbial Insights. All methods and reporting requirements were met.

7.2 Sample Holding Times and Preservation – *acceptable*

All samples were prepared and analyzed within the recommended holding period from the date of collection to analysis. Sample preservations met the QAPP (EPI, 2008) requirements.

7.3 Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the approved QAPP (EPI, 2008) with the following comments:

- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.
- RLs for Lactic and Pyruvic Acid were elevated at 25 mg/L and 10 mg/L, respectively, instead of 1 mg/L as listed in the QAPP. No action was taken.

7.4 Blank Contamination – *acceptable*

The calibration blanks and/or method blanks were free of target compounds with the following comment:

- No blank information was provided for the bacterial census

7.5 Laboratory Control Spike and/or Standard Reference Material Recovery – *acceptable*

- A standard reference material (SRM) sample was analyzed for N-nitrate, sulfate and total organic carbon for each analytical batch. All SRM recoveries were acceptable.
- An LCS was analyzed for Ferrous Iron and VFAs. The recoveries were in control.
- No LCS or SRMs were analyzed for the bacterial census. No action was taken other than to note.

7.6 Matrix Spike/Matrix Spike Duplicate Analysis

Matrix Spike (MS) analysis was performed in SDG SE88 on sample GW-110117-PL2-017A-0 for Ferrous Iron, Anions, TOC and VFAs and in SDG SF09 on sample GW-110118-PP-1B-I-0 for TOC and GW-110118-PL2-031A-0 for Ferrous Iron and Anions. In SDGs where MS data are not available refer to LCS, matrix duplicate, and/or field duplicate data for precision and accuracy information. All MS recoveries were acceptable with the following comments:

- MS/MSD analysis is not possible for bacterial census analysis. No other QC was provided.
- SDG SE88: The VFAs MS/MSD RPD for pyruvic acid was out of control high. All samples were qualified as estimated (J/UJ).
- SDG SF09: The VFA MS/MSD % Recoveries and RPDs for lactic and pyruvic acid were out of control for the batch QC. Since the MS/MSD was not performed on a client sample, no action was taken.

7.7 Duplicate Analysis – *acceptable*

Laboratory duplicate analysis was performed on SDG SE88 on sample GW-110117-PL2-017A-0 for Ferrous Iron, Anions, TOC and VFAs; in SDG SF09 on sample GW-110118-PP-1B-I-0 for TOC and GW-110118-PL2-031A-0 for Ferrous Iron and Anions; and in SDG SF22 on sample GW-110119-PL2-035A-0 for Ferrous Iron. Duplicate analysis criteria were met with the following discussion:

- No duplicates were analyzed for VFAs or qDHC. No action was taken other than to note.

7.8 Field Duplicate Sample Analysis

Field duplicate samples were collected and analyzed as follows:

Table 5: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SF09	GW-110118-PL2-021A-0	GW-110118-PL2-021A-1
SF22	GW-110119-PP-2B-I-0	GW-110119-PP-2B-I-1

Field duplicate analysis criteria were met with the following discussion:

- SDG SF09 (0371A): The field duplicate RPD for bacterial census was high at 36.6%. The parent sample and its duplicate were qualified as estimated (J/UJ).

8.0 DATA QUALIFIERS

Data qualifiers applied by the laboratory have been removed from the data summary report sheets and superseded by data validation qualifiers as follows:

The following qualifiers were used to modify the data quality and usefulness of individual analytical results.

U – The constituent was analyzed for, but was not detected above the reported sample quantitation limit.

J – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result is less than the quantitation limit or quality control criteria were not met.

J+ – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result may be biased high.

J- – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result may be biased low.

UJ – The constituent was not detected; the associated quantitation limit is an estimated value because quality control criteria were not met.

R – Data are rejected due to significant exceedance of quality control criteria. The analyte may or may not be present. Additional sampling and analysis may be required to determine the presence or absence of the constituent. For statistical reasons, rejected values are not included in the database.

UR – The constituent is rejected at the reported quantitation limit.

Y – The reporting limit is elevated due to interference. The result is not detected.

9.0 DATA ASSESSMENT

Data review and validation was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project. This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment, the data are acceptable for use except where indicated by data qualifiers, which may modify the usefulness of those individual values.

Jill Lamberts
Staff Environmental Scientist, Golder

February 7, 2011
Date

Kent Angelos
Principal & Project Director, Golder

February 14, 2011
Date

10.0 REFERENCES

EPA 2008, USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review, EPA-540-R-08-01, June, 2008.

EPA 2010, USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review, USEPA-540-R-10-011, January 2010.

EPI, 2008, Interim Measure Work Plan for 2-66 Sheetpile, Boeing Plant 2, Seattle/Tukwila, Washington, Prepared by Environmental Partners, Inc. (EPI), July 2008.

Golder Associates Inc. (Golder), 2009, Compendium of Sampling and Analysis Plans and Quality Assurance Plans for Boeing Plant 2, Prepared for The Boeing Company by Golder Associates Inc. (Golder) and Environmental Partners, Inc. (EPI), June of 2009.

TECHNICAL MEMORANDUM

Date:	June 27, 2011	**Project No.:**	013-1646-011.700.01
To:	Will Ernst	**Company:**	The Boeing Company
From:	Jill Lamberts, Staff Environmental Scientist Kent Angelos, Principal and Project Director		
cc:	Jeff Dengler and Doug Kunkel, EPI	**Email:**	jill_lamberts@golder.com

RE: BOEING PLANT 2 – 2-66 ERD IM – DATA VALIDATION QA/QC REVIEW – APRIL 2011 SAMPLING ROUND

1.0 INTRODUCTION

A total of 26 water samples (including 3 field duplicates and 4 trip blanks) were collected April 18 to 21, 2011 as part of the Boeing Plant 2 Groundwater Interim Measures Work Plan for 2-66 ERD IM (EPI, 2008). Samples were analyzed by Analytical Resources Incorporated (ARI) of Tukwila, Washington, Microbial Insights of Rockford, Tennessee, and Microseeps of Pittsburg, Pennsylvania for the following parameters:

- Volatile Organic Compounds (VOCs) by EPA Method 8260C
- Total Organic Carbon (TOC) by EPA 415.1
- Dissolved Gases (Methane, Ethane, and Ethene – MEE) by Modified RSK 175
- Dissolved Metals (Arsenic and Manganese) by EPA Methods 200.8 and 6010B
- Ferrous Iron by SM 3500 FeD
- Anions (N-Nitrate and Sulfate) by EPA 300.0
- Organic Volatile Fatty Acids (VFAs) (Pyruvic, Lactic, Acetic, Propionic, and Butyric Acids) by ion chromatography by Microseeps
- Bio-Dechlor Bacterial Census by qDHC (RT-PCR) – dehalococcoides by Microbial Insights

With the exception of the bacterial and metabolic acids analysis, samples were analyzed in accordance with procedures described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA SW-846, 3rd edition) 300.0, 415.1, 8260C, 6010B, metals, EPA Method 200.8, Revision 5.5; Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, Standard Methods for the Examination of Water and Wastewater (20th Edition).*

The bacterial and metabolic acids analyses were analyzed in accordance with the *Microbial Insights* and *Microseeps Standard Operating Procedures*.

Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA
Tel: (425) 883-0777 Fax: (425) 882-5498 www.golder.com

2.0 SAMPLE DELIVERY GROUPS, SAMPLES AND ANALYSES

Samples were analyzed and results reported by the laboratory in batch numbers as summarized below:

SS33 (VOCs, TOC, and Dissolved Metals):

GW-110418-PL2-008B-0	GW-110418-PL2-008C-0	GW-110418-PL2-041AA-0
GW-110418-PP-4B-I-0	GW-110418-PP-4B-O-0	Trip Blank

SS64, P1104216, 064ID (VOCs, TOC, MEE, Ferrous Iron, Dissolved Metals, Anions, VFAs, and qDHC):

GW-110419-PP-1B-I-0	GW-110419-PL2-021B-0	GW-110419-PL2-021A-0
GW-110419-PL2-017A-0	GW-110419-PL2-017A-1	Trip Blank

SS86, P1104244 (VOCs, TOC, MEE, Ferrous Iron, Dissolved Metals, Anions, and VFAs):

GW-110420-PL2-021C-0	GW-110420-PP-5B-I-0	GW-110420-PL2-032A-0
GW-110420-PL2-032A-1	GW-110420-PL2-031A-0	GW-110420-PP-3A-I-0
GW-110420-PP-3B-I-0	Trip Blank	

ST02 (VOCs, TOC, MEE, Ferrous Iron, and Dissolved Metals):

GW-110421-PL2-010A-0	GW-110421-PL2-035A-0	GW-110421-PP-2B-I-0
GW-110421-PP-2B-I-1	GW-110421-PP-2B-O-0	Trip Blank

Quality assurance/quality control (QA/QC) reviews of laboratory data were performed in the laboratory in accordance with the laboratory quality assurance program plan. The data validation QA/QC review focused primarily on laboratory result summary sheets and quality control summary sheets to ensure that work plan data quality objectives were met for the project.

Data validation was conducted in accordance with the criteria outlined in the National Functional Guidelines for Organic Data Review (EPA, 2008) and the National Functional Guidelines for Inorganic Data Review (EPA, 2010), modified to include method specific requirements of the laboratory analytical methods and *Interim Measure Work Plant for 2-66 Sheetpile, Boeing Plant 2 Seattle/Tukwila (EPI, 2008)*. Raw data sheets were reviewed as necessary to confirm conditions reported and to support application of qualifiers to analytical results

The validation level for the data is Level I, as described in the QAPP (EPI, 2008). The following is a summary of quality control elements associated with each analytical fraction and the status of that element as a result of the data validation process.

3.0 SAMPLING, DOCUMENTATION AND REPORTING

Sample acknowledgements, chain-of-custody, request forms and data package completeness were evaluated with the following noted:

- SDGs SS33 and SS86: Cooler receipt form indicates that the samples were received out of temperature compliance. No action was taken because the samples were collected and delivered to the lab within 3 hours.

- Multiple SDGs: Some samples were preserved in the lab instead of the in the field or analyzed within a shortened hold time. No action was required since all samples were analyzed within recommended holding times.
- SDG SS86: Cooler receipt form indicates that one of two VOC vials for the Trip blank had small air bubbles. No action was required since the samples were all analyzed within the recommended holding time.
- SDGs SS86 and ST02: Cooler receipt form indicates samples were received with headspace for Ferrous Iron analysis. The samples had proper preservation and were analyzed upon receipt so no action was taken, but exposure to the atmosphere should be minimized for future events.
- Results for volatile organic compound 1, 1, 2-trichloro-1, 2, 2-trifluoroethane are reported in a truncated format (1, 1, 2-trichloro-1, 2, 2-trifluoroe) due to ARI report format. No action was taken.

4.0 VOLATILE ORGANIC COMPOUNDS

Level 1 summary data packages were provided for the VOC analysis. The items reviewed during validation are summarized below.

4.1 Analytical Methods – *acceptable*

Samples for VOC analysis were analyzed by gas chromatography/mass spectrometry (GC/MS) using EPA SW846 Method 8260C. The QAPP lists the method for VOCs as 8260B. ARI updated their methods due to a NELAP audit and a memo dated 6/1/2009 was sent to Boeing, EPI, and Golder Project Managers informing them of the change.

4.2 Sample Holding Times and Preservations – *acceptable*

All samples were prepared and analyzed within 14 days of sample collection (preserved water samples) or within 7 days of sample collection (unpreserved water samples).

4.3 Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the approved quality assurance project plan (EPI, 2008) with the following exceptions:

- Quality assurance project plan (QAPP) reporting limits were not met for nine compounds. A review of current ARI detection limits shows that both method and reporting limits were updated (as of 6/1/2009). Compounds that do not meet QAPP stipulated reporting levels (RLs) are identified in the following table:

Table 1: 2-66 IM ERD VOC Reporting Limits

Compound	QAPP Table 6 RLs (µg/L)	Lab Reported RLs µg/L
Chloromethane	0.2	0.5
Bromomethane	0.2	1.0
Methylene Chloride	0.3	0.5
Acetone	3.0	5.0

Compound	QAPP Table 6 RLs (µg/L)	Lab Reported RLs µg/L
2-Butanone	2.0	5.0
Vinyl Acetate	0.5	1.0
2-Chloroethylvinylether	0.5	1.0
4-Methyl-2-Pentanone	2.0	5.0
2-Hexanone	2.0	5.0

- No action was taken; this change in the RLs was sent by ARI to Boeing, EPI, and Golder Project Managers on June 1, 2009 and subsequently approved and implemented as part of the June 2009 QAPP compendium (Golder, 2009).
- Trichloroethene is listed twice in QAPP Table 5. No action was taken.
- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds.

4.4 Instrument Calibration

Calibration review is not required under the QAPP; however, the lab provided information on the calibration performance in the case narratives. All of the calibration criteria were met with the following exceptions:

- SDG SS64: The continuing calibration standard (CCAL) on 4/20/2011 was out of control for Bromoform. Associated samples were qualified as estimated (J/UJ) for this analyte.
- SDG SS64: The initial calibration standard (ICAL) on 4/20/2011 and 4/26/2011 was out of control for 2-chloroethylvinylether (2CEVE). Associated samples were qualified as rejected for non-detects (UR) or estimated for detects (J) for this analyte.
- SDG SS64: The CCAL on 4/26/2011 was out of control for 2CEVE. Since it was already qualified due to ICAL issues, no further action was taken.
- SDG SS86: The CCAL on 4/22/2011was out of control for chloromethane. Associated samples were qualified as estimated (J/UJ) for this analyte.
- SDG ST02: The ICAL and CCAL were out of control for 2CEVE. Associated samples were qualified as rejected for non-detects (UR) or estimated for detects (J) for this analyte.

4.5 Blank Contamination – *acceptable*

The method blanks and trip blanks were free of contamination.

4.6 Surrogate Recovery – *acceptable*

All surrogate recoveries were within control limits.

4.7 Matrix Spike Compound Recovery

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) analysis was performed on GW-110418-PL2-041AA-0 in SDG SS33 and on GW-110419-PL2-017A-0 in SDG SS64. In SDGs where MS/MSD data are not available refer to LCS/LCSD and field duplicate data for precision and accuracy information. All MS/MSD recoveries and relative percent differences (RPDs) were acceptable with the following exceptions:

- SDG SS64: The MS/MSD was out of control for 2CEVE and Bromoform. No action was taken because these analytes were already qualified due to poor calibration response.

4.8 Laboratory Control Sample Recovery

Laboratory control samples (LCS) were evaluated using control limits listed in Table 4 of the QAPP (EPI, 2008) and recently updated CLs on the ARI website. All LCS/LSCD recoveries and relative percent differences (RPDs) were acceptable with the following exceptions:

- SDG SS64: The LCS and/or LCSD from 4/20/2011 was out of control for 2CEVE and Bromoform and had a poor RPD for 2CEVE. No action was taken as these analytes were already qualified due to poor calibration responses.
- SDG SS64: The LCSD from 4/26/2011 was out of control for 2CEVE. The LCS was in control. No action was taken other than to note.
- SDG ST02: The LCSD was out of control for 2CEVE. The LCS was in control. No action was taken other than to note.

4.9 Field Duplicate Sample Analysis – *acceptable*

Field duplicate samples were collected and analyzed as follows:

Table 2: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SS86	GW-110420-PL2-032A-0	GW-110420-PL2-032A-1
ST02	GW-110421-PP-2B-I-0	GW-110421-PP-2B-I-1

Field duplicate analysis criteria were met.

5.0 METHANE, ETHANE, AND ETHENE (MEE)

The laboratory provided Level I summary forms for compounds methane, ethane, and ethene. The items reviewed during validation are summarized below.

5.1 Analytical Methods – *acceptable*

Samples for MEE parameters were analyzed using EPA Method RSK-175 (Modified).

5.2 Sample Holding Times and Preservations

All samples were prepared and analyzed within the recommended holding times 14 days from collection to analysis. Please note that the QAPP stipulates that the hold time for MEE is 7 days. The lab was contacted to verify the hold time 5/11/2009. The lab responded that the QAPP was incorrect and the true hold time is 14 days. No action required other than to note.

5.3 Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the QA Plan with the following exception:

- Table 5 of the QAPP stipulates a reporting level of 1.0 µg/L for methane, ethane, and ethene. The ARI reporting limits are 0.7 µg/L for methane, 1.2 µg/L for ethane, and 1.1 µg/L for ethane. EPI's project manager was contacted and approved the slightly higher limits [personal comm. J. Dengler]. No further action was taken other than to note this.
- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.

5.4 Blank Contamination – *acceptable*

The method and equipment blanks were free of target compounds.

5.5 Surrogate Recovery – *acceptable*

All surrogate recoveries were within control limits.

5.6 Matrix Spike Compound Recovery – *acceptable*

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) analysis was performed on GW-110419-PL2-017A-0 in SDG SS64. In SDGs where MS/MSD data are not available refer to LCS/LCSD and field duplicate data for precision and accuracy information. All MS/MSD recoveries and relative percent differences (RPDs) were acceptable.

5.7 Laboratory Control Sample Recovery – *acceptable*

Laboratory control samples (LCS) were evaluated and were within the control limits listed in the QAPP (EPI, 2008).

5.8 Field Duplicate Sample Analysis – *acceptable*

Field duplicate samples were collected and analyzed as follows:

Table 3: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SS86	GW-110420-PL2-032A-0	GW-110420-PL2-032A-1

Field duplicate analysis criteria were met.

6.0 INORGANICS – DISSOLVED METALS

The laboratory provided a provided a summary data package for review of metals analyses and the items reviewed during validation are summarized below.

6.1 Analytical Methods – *acceptable*

Samples for dissolved metals analysis were prepared using EPA Methods 3010A. Samples for dissolved metals analysis were completed by EPA Methods 200.8 for arsenic and EPA Method 6010B for manganese. No sampling, documentation, and reporting discrepancies were noted.

6.2 Sample Holding Times and Preservation – *acceptable*

All samples were prepared and analyzed within the recommended holding period from the date of collection (180 days for metals). All holding time criteria were met.

6.3 Laboratory Reporting Limits – *acceptable*

All metals listed in the Interim Measure Work Plan (2008) QAPP were analyzed for and requested reporting levels were met with the following discussion:

- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.

6.4 Blank Contamination – *acceptable*

The method blanks were free of target compounds.

6.5 Laboratory Control Sample Recovery – *acceptable*

LCS (blank spike) recoveries were within QC limits of 80 to 120 percent.

6.6 Matrix Spike/Matrix Spike Duplicate Analysis – *acceptable*

Matrix Spike (MS) analysis was performed on GW-110420-PL2-017A-0 in SDG SS64. In SDGs where MS data are not available refer to LCS, matrix duplicate, and field duplicate data for precision and accuracy information. All MS recoveries were acceptable.

6.7 Duplicate Analysis – *acceptable*

Laboratory duplicate analysis was performed on the same selected sample as for the MS analysis listed in the previous section. Duplicate analysis criteria were met with the following discussion:

- SDG SS64: The lab indicated on the case narrative that the RPD for manganese was out of control. Upon inspection, the validator determined that the results were less than 5 times the RL so no further action was required.

6.8 Field Duplicate Sample Analysis – *acceptable*

Field duplicate samples were collected and analyzed as follows:

Table 4: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SS86	GW-110420-PL2-032A-0	GW-110420-PL2-032A-1
ST02	GW-110421-PP-2B-I-0	GW-110421-PP-2B-I-1

Field duplicate analysis criteria were met.

7.0 GENERAL CHEMISTRY - TOTAL ORGANIC CARBON, FERROUS IRON, N-NITRATE AND SULFATE, VOLATILE FATTY ACIDS, AND BACTERIAL CENSUS

The laboratory (ARI) provided a Level I data package for analysis TOC, ferrous iron, and anions; the items reviewed during validation are summarized below. Microseeps provided a Level I data package for analysis of the organic volatile fatty acids (VFAs) and Microbial Insights provided the same for the bacterial census analysis.

7.1 Analytical Methods and Reporting – *acceptable*

The anions (N-Nitrate, and Sulfate) were analyzed using EPA method 300.0. Total Organic Carbon was analyzed by EPA Method 415.1. Ferrous Iron was analyzed by Standard Method 3500 FeD. Organic Volatile Fatty Acids (VFAs) (Pyruvic, Lactic, Acetic, Propionic, and Butyric) were analyzed by ion chromatography at Microseeps. The Bio-Dechlor Bacterial Census was analyzed by qDHC (RT-PCR) – dehalococcoides by Microbial Insights. All methods and reporting requirements were met.

7.2 Sample Holding Times and Preservation – *acceptable*

All samples were prepared and analyzed within the recommended holding period from the date of collection to analysis. Sample preservations met the QAPP (EPI, 2008) requirements.

7.3 Laboratory Reporting Limits

The laboratory achieved the reporting limits (RLs) required by the approved QAPP (EPI, 2008) with the following comments:

- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds. No action was taken.
- RLs for Lactic and Pyruvic Acid were elevated at 25 mg/L and 10 mg/L, respectively, instead of 1 mg/L as listed in the QAPP. No action was taken. RLs for Acetic, Propionic, and Butyric Acid were elevated to 5.0 mg/L instead of 1 mg/L as listed in the QAPP. No action was taken other than to note.

7.4 Blank Contamination – *acceptable*

The calibration blanks and/or method blanks were free of target compounds with the following comment:

- No blank information was provided for the bacterial census.

7.5 Laboratory Control Spike and/or Standard Reference Material Recovery – *acceptable*

- A standard reference material (SRM) sample was analyzed for N-nitrate, sulfate and total organic carbon for each analytical batch. All SRM recoveries were acceptable.
- An LCS was analyzed for Ferrous Iron and VFAs. The recoveries were in control.
- No LCS or SRMs were analyzed for the bacterial census. No action was taken other than to note.

7.6 Matrix Spike/Matrix Spike Duplicate Analysis

Matrix Spike (MS) analysis was performed in SDG SS33 on sample GW-110418-PL2-008B-0 for TOCs; in SDG SS64 on sample GW-110119-PL2-017A-0 for TOC, anions, ferrous iron, and VFAs; in SDG SS86 on sample GW-110420-PL2-021C-0 for TOC and on sample GW-110420-PL2-032A-0 for VFA; and in SDG STO2 on sample GW-110421-PL2-010A-0 for TOC. In SDGs where MS data are not available refer to LCS, matrix duplicate, and/or field duplicate data for precision and accuracy information. All MS recoveries were acceptable with the following comments:

- MS/MSD analysis is not possible for bacterial census analysis. No other QC was provided.
- SDG SS86: The VFA MS/MSD RPDs for pyruvic acid was out of control. All samples were qualified as estimated (J/UJ).

7.7 Duplicate Analysis – *acceptable*

Laboratory duplicate analysis was performed in SDG SS33 on sample GW-110418-PL2-008B-0 for TOCs; in SDG SS64 on sample GW-110119-PL2-017A-0 for TOC, anions, and ferrous iron; in SDG SS86 on sample GW-110420-PL2-021C-0 for TOC and on sample GW-110420-PL2-032A-0 for ferrous iron; and in SDG ST02 on sample GW-110421-PL2-010A-0 for TOC and on sample GW-110421-PL2-035A-0 for ferrous iron. Duplicate analysis criteria were met with the following discussion:

- No duplicates were analyzed for VFAs or qDHC. No action was taken other than to note.

7.8 Field Duplicate Sample Analysis

Field duplicate samples were collected and analyzed as follows:

Table 5: Field Duplicates

Lab SDG	Sample	Field Duplicate Sample
SS64	GW-110419-PL2-017A-0	GW-110419-PL2-017A-1
SS86	GW-110420-PL2-032A-0	GW-110420-PL2-032A-1
ST02	GW-110421-PP-2B-I-0	GW-110421-PP-2B-I-1

Field duplicate analysis criteria were met with the following discussion:

- SDG S64 (0641D): The field duplicate RPD for bacterial census was high at 80.6%. The parent sample and its duplicate were qualified as estimated (J/UJ).

8.0 DATA QUALIFIERS

Data qualifiers applied by the laboratory have been removed from the data summary report sheets and superseded by data validation qualifiers as follows:

The following qualifiers were used to modify the data quality and usefulness of individual analytical results.

U – The constituent was analyzed for, but was not detected above the reported sample quantitation limit.

J – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result is less than the quantitation limit or quality control criteria were not met.

J+ – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result may be biased high.

J- – The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result may be biased low.

UJ – The constituent was not detected; the associated quantitation limit is an estimated value because quality control criteria were not met.

R – Data are rejected due to significant exceedance of quality control criteria. The analyte may or may not be present. Additional sampling and analysis may be required to determine the presence or absence of the constituent. For statistical reasons, rejected values are not included in the database.

UR – The constituent is rejected at the reported quantitation limit.

Y – The reporting limit is elevated due to interference. The result is not detected.

9.0 DATA ASSESSMENT

Data review and validation was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project. This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment, the data are acceptable for use except where indicated by data qualifiers, which may modify the usefulness of those individual values.

Jill Lamberts
Staff Environmental Scientist, Golder

June 27, 2011
Date

Kent Angelos
Principal & Project Director, Golder

June 30,2011
Date

10.0 REFERENCES

EPA 2008, USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review, EPA-540-R-08-01, June, 2008.

EPA 2010, USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review, USEPA-540-R-10-011, January 2010.

EPI, 2008, Interim Measure Work Plan for 2-66 Sheetpile, Boeing Plant 2, Seattle/Tukwila, Washington, Prepared by Environmental Partners, Inc. (EPI), July 2008.

Golder Associates Inc. (Golder), 2009, Compendium of Sampling and Analysis Plans and Quality Assurance Plans for Boeing Plant 2, Prepared for The Boeing Company by Golder Associates Inc. (Golder) and Environmental Partners, Inc. (EPI), June of 2009.